Sensata Technologies

CPOS SERIES

Cylinder Pressure Only Sensors

WORLD CLASS SENSING TECHNOLOGY

The CPOS Series in–cylinder combustion sensor is Sensata's piezo–resistive stand–alone combustion sensing technology to detect abnormal combustion in gasoline engines and help reduce raw emissions for diesels.

With in–cylinder developments reaching back to 1985 and a company history of more than 95 years, Sensata Technologies is a leading global manufacturer of sensors and switches.

This specification describes the general functional, electrical and mechanical performance of a pressure sensor in production and intended to be used to sense combustion pressure inside an engine combustion chamber: the Cylinder Pressure Only Sensor, or CPOS. The CPOS consists of a micro-fused strain gauge (MSG), custom ASIC signal conditioning, and metal housing with integral connector. The sensor provides an analogue voltage, proportional to the applied pressure and supply voltage.

FEATURES

- Micro–fused strain gage (MSG) technology, proven for glow-plug integrated sensing, powertrain and safety sensors
- Stable output (< ±2%) over life
- Integrated dynamic offset compensation
- Full internal and external diagnostics: enables combustion feedback from inside the cylinder
- Bandwidth: >15kHz
- Currently in production
- Detects abnormal combustion in gasoline engines
- Helps reduce raw emissions in diesel engines

BENEFITS OF CLOSED LOOP COMBUSTION

- Emissions reduction: soot, NOx and/or HC
- Improve efficiency: reduce CO2, improve fuel economy
- Compensate for tolerances: engine to engine, cylinder balancing, fuel and air composition variability, etc.
- Potential savings:
  - Switch back to low cost injectors (piezo > magnet)
  - Avoid second NOx sensor for OBD, avoid fuel quality sensor, etc.
  - Eventually replace knock sensor, camshaft sensor, etc.
- Increase engine power, torque calculation (IMEP)
- Noise reduction: combustion noise (smoothness of engine) and audible noise
- Control EGR
- Reduce engine development time at OEM and service diagnostics
- Enabler for homogeneous combustion: HCCI

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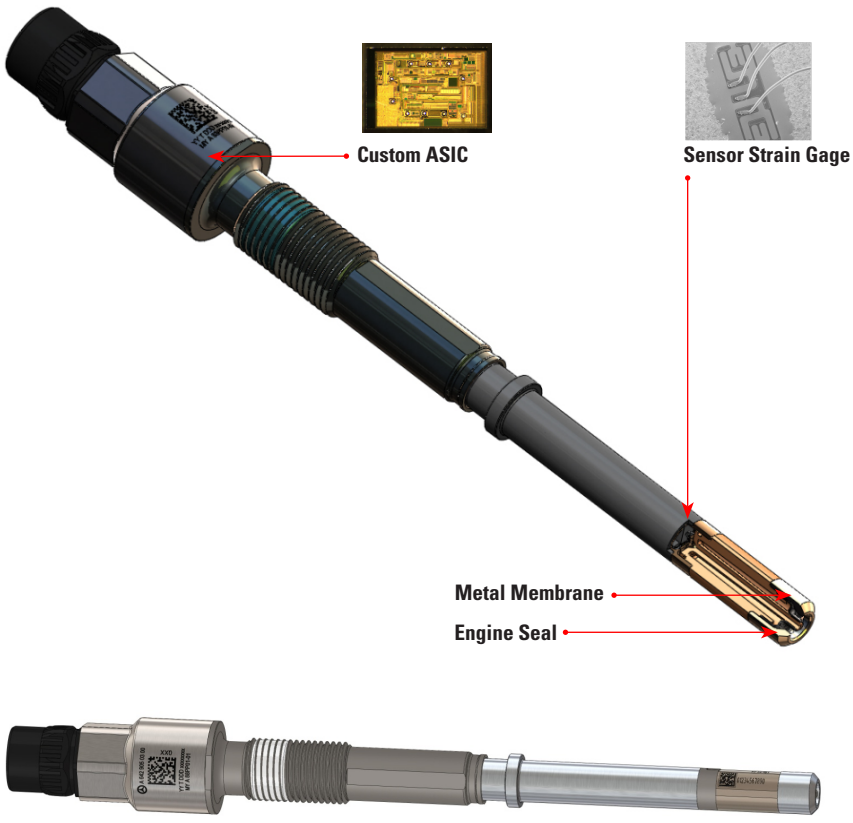
CONFIGURATION

Mounting Dimension	HEX12
Thread of the Pressure Port	M10x1 (M8 available)
Electrical Connector	Coaxial connection system

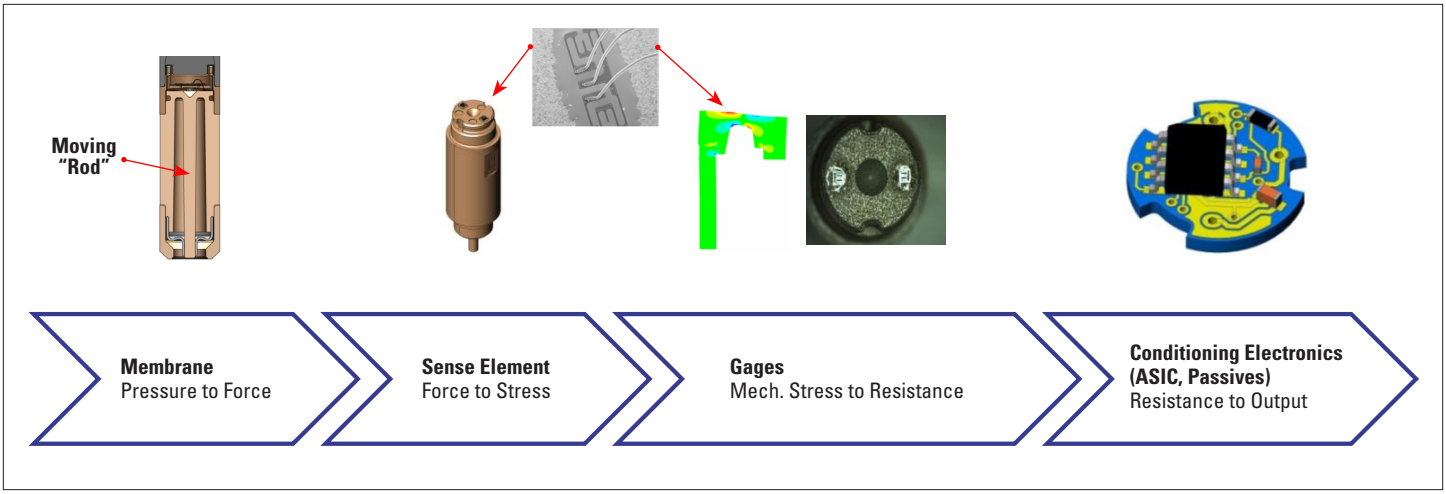
FUNCTIONAL CHARACTERISTICS

Operating Temperature	-40°C to 140°C
Operating Pressure	Customer specific: 0 to 150 / 250 Bar
Proof Pressure	Customer specific (250 bar)
Burst Pressure	Customer specific (300 bar)
Lifetime Expectancy	250.000 km and beyond 12.000 hours
Stable Output	± 2% over lifetime
Gain Accuracy	± 2% of Vs over life
Non Linearity	< ± 1% of Vs over life
Hysteresis	< ± 1% of Vs over life
Offset Variation	± 1% of Vs over life
Accuracy	0–5 bar low pressure: ±0.4% of Vs (10°C to 140°C) ±0.6% of Vs (-40°C to 10°C)
Supply Voltage	5.0 ± 5% VDC (customer specific)
Supply Current	Max 10mA
Load Resistor	4.7kOhm pull up
Response Time For Signal Delay	<200us total
Nominal Output Voltage	11.5%Vs to 91.5%Vs
Output Noise RMS	<0.2% of Vs
Overvoltage Protection	24V
Reverse Voltage Protection	-13.5V
Signal Resolution	<50mBar (analog)
Bandwidth	15kHz

DIAGRAM 1



PHYSICAL TRANSFORMATION FROM COMBUSTION PRESSURE TO OUTPUT SIGNAL

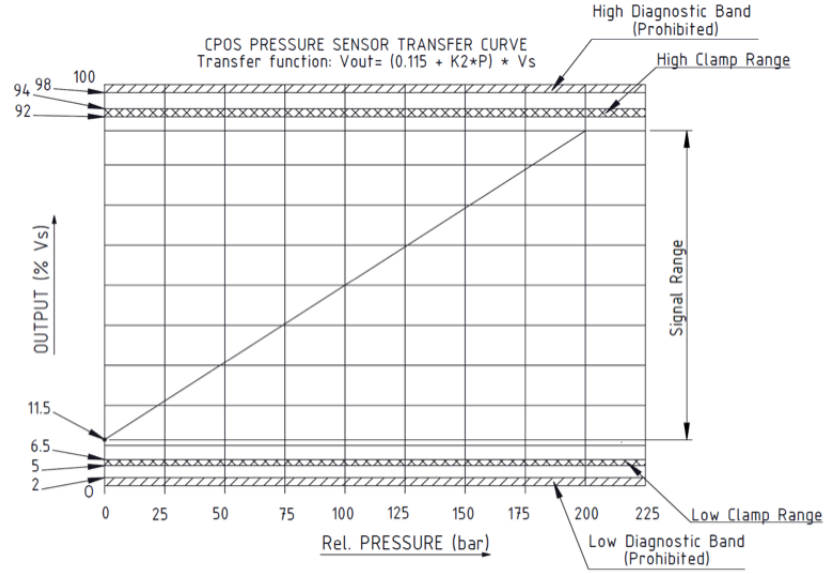


A cylinder pressure sensor enables combustion feedback from inside the cylinder:

Partial "Open Loop" Combustion + **Cylinder Pressure Sensor** = **Full Closed Loop Combustion**

TRANSFER CURVE

This graph represents the nominal output curve of the CPOS sensor (output voltage in %Vs versus pressure)



Nominal Transfer Curve is expressed by:	Vout=Vs*(K2*P+K1)
Supply	Vs
Offset	K1 = 0.115+/-0.01
Slope	K2
P	Pressure (bar)

DIAGNOSTIC FAULT MODES

High Fault Band Output	≥ 98%Vs In case of internal fault, typically the output signal is 99%Vs
Low Fault Band Output	≤ 2%Vs In case of internal fault, typically the output signal is 1%Vs

SENSOR "CLAMP" LEVELS

Nominal High Clamp Level	Fixed at 93% of Vs
Nominal Low Clamp Level	Fixed at 6% of Vs
High Clamp Level	Minimum: 92%Vs Maximum: 94%Vs
Low Clamp Level	Minimum: 5%Vs Maximum: 6.5%Vs

NOTE: In case the under–pressure or over–pressure situation is abandoned, the sensor needs 1ms in order to provide the normal output signal again.

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