



# TYRE PRESSURE SENSOR WITH ACCELEROMETER

SP12 is a piezoresistive pressure sensor and accelerometer designed for tyre pressure measurement applications. The design is based on proven high-volume, low cost production processes developed for products to be used in automotive applications. The SP12 is supplied in a 14 pin SOP (Small Outline Package) plastic package.

The sensor design is based upon SensoNor's proprietary and patented solutions aimed at high reliability measurements in harsh environments, still with a predictable and stable quality in high volume applications.

The SP12 measures pressure, temperature, supply voltage and radial acceleration, and by integrating these functions with an ASIC in one package, SensoNor has developed the ideal product for tyre pressure monitoring applications, offering the system designer the flexibility to determine sequences and functionality according to his customers demands.

|                          |        |               |
|--------------------------|--------|---------------|
| ■ Pressure sensor:       | Range: | 100 to 450kPa |
| ■ Temperature sensor:    | Range: | -40 to +125°C |
| ■ Supply Voltage sensor: | Range: | 1.8 to 3.6V   |
| ■ Acceleration sensor:   | Range: | -12 to 115g   |

## SP12



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## PRESSURE MEASUREMENTS

All specification limits to be understood as 4 sigma values. The specified values reflect the situation with an ideal voltage source (0 ohm internal resistance)

PACKAGE TYPE 6

| PARAMETER         | SPECIFICATION |      |      |     | AMBIENT CONDITION |                |                    |
|-------------------|---------------|------|------|-----|-------------------|----------------|--------------------|
|                   | Unit          | Min  | Typ  | Max | Temperature [°C]  | Pressure [kPa] | Supply voltage [V] |
| Input range       | kPa           | 100  | --   | 450 | -40 to 125        | 100 - 450      | 2.1 - 3.6          |
| Resolution        | kPa/lb        |      | 1.37 |     | -40 to 125        | 100 - 450      | 2.1 - 3.6          |
| Measurement error | kPa           | -8.5 |      | 8.5 | 0 to 50           | 200 - 400      | 2.1 - 3.6          |
|                   | kPa           | -20  |      | 20  | 0 to 50           | 100 - 450      | 2.1 - 3.6          |
|                   | kPa           | -10  |      | 10  | -20 to 70         | 200 - 400      | 2.1 - 3.6          |
|                   | kPa           | -25  |      | 25  | -20 to 70         | 100 - 450      | 2.1 - 3.6          |
|                   | kPa           | -17  |      | 17  | -40 to 100        | 200 - 400      | 2.1 - 3.6          |
|                   | kPa           | -30  |      | 30  | -40 to 100        | 100 - 450      | 2.1 - 3.6          |
|                   | kPa           | -25  |      | 25  | 100 to 125        | 200 - 400      | 2.1 - 3.6          |
|                   | kPa           | -40  |      | 40  | 100 to 125        | 100 - 450      | 2.1 - 3.6          |
| Measurement time  | ms            |      |      | 6   |                   |                |                    |

## TEMPERATURE MEASUREMENTS

All specification limits to be understood as 5 sigma values

| PARAMETER                         | SPECIFICATION |     |     |     | AMBIENT CONDITION |                    |
|-----------------------------------|---------------|-----|-----|-----|-------------------|--------------------|
|                                   | Unit          | Min | Typ | Max | Temperature [°C]  | Supply voltage [V] |
| Input range                       | °C            | -40 | --  | 125 | -40 to 125        | 2.1 - 3.6          |
| Resolution                        | °C/lb         |     | 1   |     | -40 to 125        | 2.1 - 3.6          |
| Deviation from actual temperature | °C            | -4  |     | 4   | 0 to 50           | 2.5 - 3.6          |
|                                   | °C            | -5  |     | 5   | -40 to 100        | 2.5 - 3.6          |
|                                   | °C            | -8  |     | 8   | +100 to 125       | 2.5 - 3.6          |
|                                   | °C            | -7  |     | 7   | 0 to 50           | 2.1 - 2.5          |
|                                   | °C            | -10 |     | 10  | -40 to 125        | 2.1 - 2.5          |
| Measurement time                  | ms            |     |     | 1.5 |                   |                    |

## ACCELEROMETER MEASUREMENTS

All specification limits to be understood as 4 sigma values. The specified values reflect the situation with an ideal voltage source (0 ohm internal resistance)

| PARAMETER                                              | SPECIFICATION |        |     |       | AMBIENT CONDITION |                    |
|--------------------------------------------------------|---------------|--------|-----|-------|-------------------|--------------------|
|                                                        | Unit          | Min    | Typ | Max   | Temperature [°C]  | Supply voltage [V] |
| Input range                                            | g             | -12    |     | 115   | -40 to 90         | 2.1 to 3.6         |
| Resolution                                             | g/lb          |        | 0.5 |       | -40 to 90         | 2.1 to 3.6         |
| Sensitivity accuracy                                   | %             | -18.75 |     | 18.75 | -40 to 90         | 2.1 to 3.6         |
|                                                        | %             | -24    |     | 24    | 90 to 125         | 2.1 to 3.6         |
| Offset                                                 | g             | -6     |     | 6     | 25                | 2.1 to 3.6         |
|                                                        | g             | -8.75  |     | 8.75  | -40 to 90         | 2.1 to 3.6         |
|                                                        | g             | -12    |     | 12    | 90 to 125         | 2.1 to 3.6         |
| Random error (inc. quant. error, noise, repeatability) | g             | -2     |     | 2     | -40 to 90         |                    |
|                                                        | g             | -4     |     | 4     | 90 to 125         |                    |
| Measurement time                                       | ms            |        |     | 6     |                   |                    |

## SUPPLY VOLTAGE MEASUREMENTS

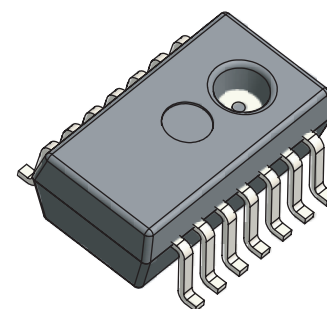
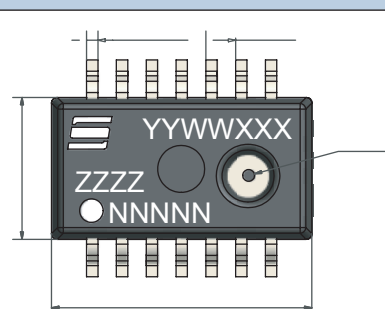
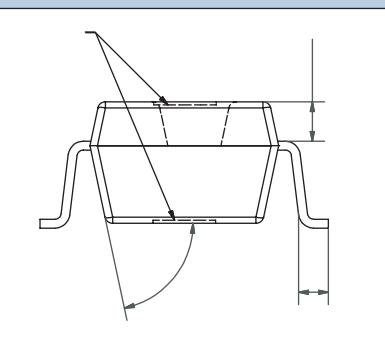
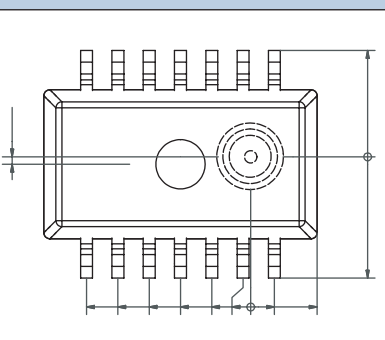
All specification limits to be understood as 4 sigma values

| PARAMETER                                                          | SPECIFICATION |      |        |     | AMBIENT CONDITION |                    |
|--------------------------------------------------------------------|---------------|------|--------|-----|-------------------|--------------------|
|                                                                    | Unit          | Min  | Typ    | Max | Temperature [°C]  | Supply voltage [V] |
| Input range                                                        | V             | 1.8  |        | 3.6 | -40 to 125        | 1.8 - 3.6          |
| Resolution                                                         | V/lb          |      | 0.0184 |     | -40 to 125        | 2.1 - 3.6          |
| Measurement error                                                  | V             | -0.1 |        | 0.1 | -40 to 125        | 2.1 - 3.6          |
| Delay time between supply voltage measurement command and sampling | ms            | 2.8  | 3.5    | 4.2 | -40 to 125        | 2.1 - 3.6          |
| Delay time between sampling and A/D conversion                     | ms            | 8    | 10     | 12  | -40 to 125        | 2.1 - 3.6          |
| Measurement time                                                   | ms            |      |        | 17  |                   |                    |

## ABSOLUTE MAXIMUM RATINGS

Prolonged exposure to values between recommended operating conditions and absolute maximum ratings might affect the performance or reliability of the device

| PARAMETER                         | MIN  | MAX       | UNIT |
|-----------------------------------|------|-----------|------|
| Input pressure                    |      | 1400      | kPa  |
| Storage temperature               | -40  | 150       | °C   |
| Temperature in application        | -40  | 150       | °C   |
| Temperature, transient            | -40  | 175       | °C   |
| Supply voltage                    | -0.3 | 6.0       | V    |
| Input voltage, any pin            | -0.3 | VDD + 0.3 | V    |
| Latch-up protection               | -100 | 100       | mA   |
| ESD protection (machine model)    | -200 | 200       | V    |
| ESD protection (human body model) | -2   | 2         | kV   |
| Mechanical shock                  |      | 2000      | g    |
| Static acceleration               |      | 2000      | g    |



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