



# MPXC2011DT1, 0 to 10 kPa, Differential, Compensated Pressure Sensor

Freescale Semiconductor has developed a high volume, miniature pressure sensor package which is ideal as a sub-module component or a disposable unit. The unique concept of the Chip Pak allows great flexibility in system design while providing an economic solution for the designer. This new chip carrier package uses Freescale Semiconductor's unique sensor die with its piezoresistive technology, along with the added feature of on-chip, thin-film temperature compensation and calibration.

### Features

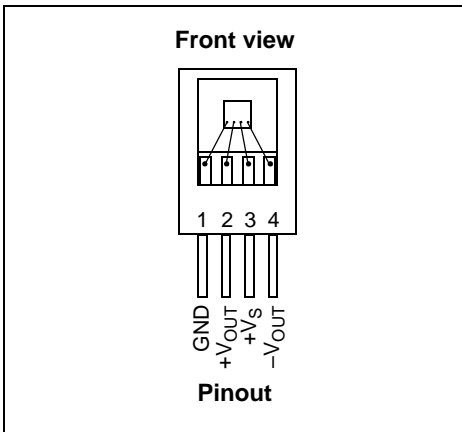
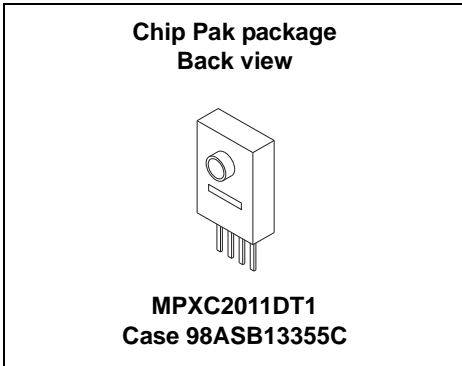
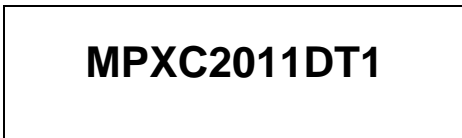
- Integrated temperature compensation and calibration
- Ratiometric to supply voltage
- Polysulfone case material (ISO 10993)
- Provided in easy-to-use tape and reel

### Typical applications

- Respiratory diagnostics
- Air movement control
- Controllers
- Pressure switching

### NOTE

The die and wire bonds are exposed on the front side of the chip pak (pressure is applied to the backside of the device). Front side die and wire protection must be provided in the customer's housing. Use caution when handling the devices during all processes.



Ordering Information						
Device Name	Shipping	Package	Pressure Type			Device Marking
			Gauge	Differential	Absolute	
MPXC2011DT1	Tape and Reel	98ASB13355C		•		XXXX = Device code XXX = Trace code

Freescale reserves the right to change the detail specifications as may be required to permit improvements in the design of its products.

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## Related Documentation

The MPXC2011DT1 device features and operations are described in a variety of reference manuals, user guides, and application notes. To find the most-current versions of these documents:

1. Go to the Freescale homepage at:  
<http://www.freescale.com/>
2. In the Keyword search box at the top of the page, enter the device number MPXC2011DT1.
3. In the Refine Your Result pane on the left, click on the Documentation link.

### MPXC2011DT1

# 1 General Description

Freescale Semiconductor's MPXC2011DT1 Pressure Sensor has been designed for medical usage by combining the performance of Freescale Semiconductor's shear stress pressure sensor design and the use of biomedically approved materials. Materials with a proven history in medical situations have been chosen to provide a sensor that can be used with confidence in applications, such as invasive blood pressure monitoring. It can be sterilized using ethylene oxide. The portions of the pressure sensor that are required to be biomedically approved are the rigid housing and the gel coating.

The rigid housing is molded from a white, medical grade polysulfone that has passed extensive biological testing including: ISO 10993-5:1999, ISO 10993-10:2002, and ISO 10993-11:1993.

The MPXC2011DT1 contains a silicone dielectric gel which covers the silicon piezoresistive sensing element. The gel is a nontoxic, nonallergenic elastomer system which meets all USP XX Biological Testing Class V requirements. The properties of the gel allow it to transmit pressure uniformly to the diaphragm surface, while isolating the internal electrical connections from the corrosive effects of fluids, such as saline solution. The gel provides electrical isolation sufficient to withstand defibrillation testing, as specified in the proposed Association for the Advancement of Medical Instrumentation (AAMI) Standard for blood pressure transducers. A biomedically approved opaque filler in the gel prevents bright operating room lights from affecting the performance of the sensor.

## 1.1 Block diagram

Figure 1 shows a block diagram of the internal circuitry integrated on a pressure sensor chip.

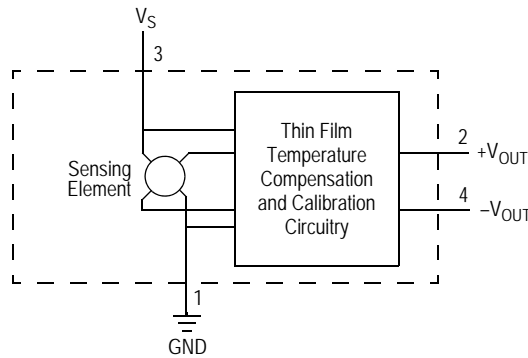


Figure 1. Block diagram

## 1.2 Pinout

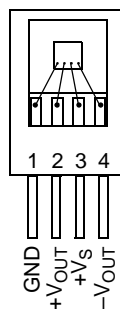


Figure 2. Device pinout (front view)

Table 1. Pin functions

Pin	Name	Function
1	GND	Ground
2	+V <sub>OUT</sub>	Output voltage
3	+V <sub>S</sub>	Voltage supply
4	-V <sub>OUT</sub>	Output voltage

## 2 Mechanical and Electrical Specifications

### 2.1 Maximum ratings

**Table 2. Maximum ratings<sup>(1)</sup>**

Rating	Symbol	Value	Unit
Maximum pressure (backside)	$P_{max}$	75	kPa
Storage temperature	$T_{stg}$	-25 to +85	°C
Operating temperature	$T_A$	+15 to +40	°C

1. Exposure beyond the specified limits may cause permanent damage or degradation to the device.

### 2.2 Operating characteristics

**Table 3. Operating characteristics** ( $V_S = 10 V_{DC}$ ,  $T_A = 25 °C$  unless otherwise noted,  $P_1 > P_2$ )

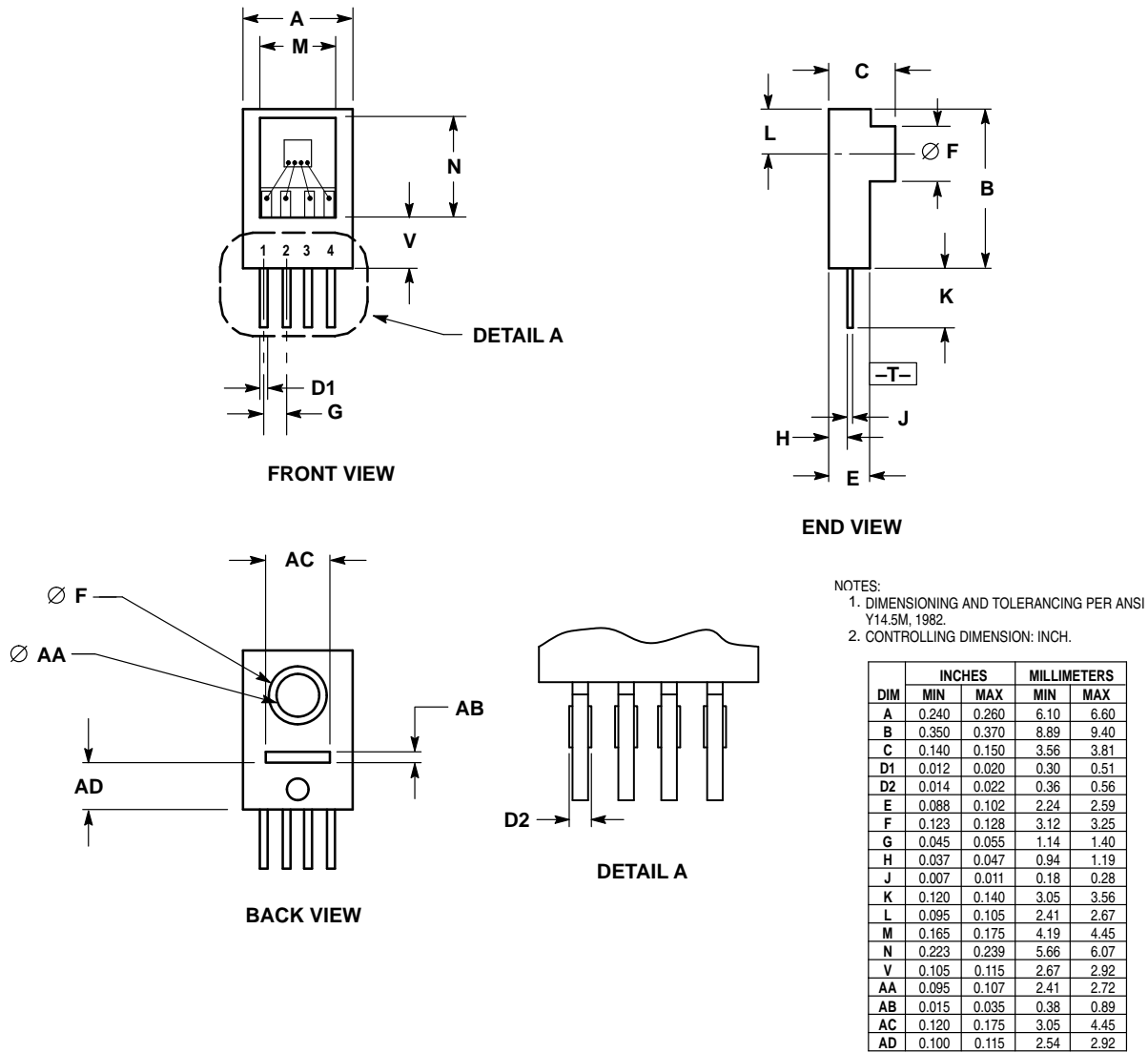
Characteristic	Symbol	Min	Typ	Max	Unit
Pressure range <sup>(1)</sup>	$P_{OP}$	0	—	10	kPa
Supply voltage <sup>(2)</sup>	$V_S$	—	3	10	$V_{DC}$
Supply current	$I_O$	—	6.0	—	mA <sub>dc</sub>
Full-scale span <sup>(3)</sup>	$V_{FSS}$	24	25	26	mV
Offset <sup>(4)</sup>	$V_{OFF}$	-1.0	—	1.0	mV
Sensitivity	$\Delta V/\Delta P$	—	2.5	—	mV/kPa
Linearity <sup>(5)</sup>	—	-1.0	—	1.0	% $V_{FSS}$
Pressure hysteresis <sup>(5)</sup> (0 to 10 kPa)	—	—	±0.1	—	% $V_{FSS}$
Temperature hysteresis <sup>(5)</sup> (+15 °C to +40 °C)	—	—	±0.1	—	% $V_{FSS}$
Temperature effect on full-scale span <sup>(5)</sup>	$TCV_{FSS}$	-1.0	—	1.0	% $V_{FSS}$
Temperature effect on offset <sup>(5)</sup>	$TCV_{OFF}$	-1.0	—	1.0	mV
Input impedance	$Z_{IN}$	1300	—	2550	$\Omega$
Output impedance	$Z_{OUT}$	1400	—	3000	$\Omega$
Response time <sup>(6)</sup> (10% to 90%)	$t_R$	—	1.0	—	ms
Warm-up	—	—	20	—	ms
Offset stability <sup>(7)</sup>	—	—	±0.5	—	% $V_{FSS}$

- 1.0 kPa (kilo Pascal) equals 0.145 psi.
- Device is ratiometric within this specified excitation range. Operating the device above the specified excitation range may induce additional error due to device self-heating.
- Full-scale span ( $V_{FSS}$ ) is defined as the algebraic difference between the output voltage at full rated pressure and the output voltage at the minimum rated pressure.
- Offset ( $V_{OFF}$ ) is defined as the output voltage at the minimum rated pressure.
- Accuracy (error budget) consists of the following:
  - Linearity: Output deviation from a straight line relationship with pressure, using end point method, over the specified pressure range.
  - Temperature Hysteresis: Output deviation at any temperature within the operating temperature range, after the temperature is cycled to and from the minimum or maximum operating temperature points, with zero differential pressure applied.
  - Pressure Hysteresis: Output deviation at any pressure within the specified range, when this pressure is cycled to and from the minimum or maximum rated pressure, at 25 °C.
  - TcSpan: Output deviation at full rated pressure over the temperature range of 0 to 85 °C, relative to 25 °C.
  - TcOffset: Output deviation with minimum rated pressure applied, over the temperature range of 0 to 85 °C, relative to 25 °C.
- Response Time is defined as the time for the incremental change in the output to go from 10% to 90% of its final value when subjected to a specified step change in pressure.
- Offset stability is the product's output deviation when subjected to 1000 hours of Pulsed Pressure, Temperature Cycling with Bias Test.

### 3 Package Dimensions

#### 3.1 Package description

This drawing is located at [http://cache.freescale.com/files/shared/doc/package\\_info/98ASB13355C.pdf](http://cache.freescale.com/files/shared/doc/package_info/98ASB13355C.pdf).



Case 98ASB13355C, Chip Pak package



## 4 Revision History

Table 4. Revision history

Revision number	Revision date	Description
9	10/2012	<ul style="list-style-type: none"><li>Deleted references to device number MPXC2012DT (a no-gel option) throughout the document.</li></ul>
10	08/2014	<ul style="list-style-type: none"><li>Added pin descriptions and pin numbers.</li></ul>
11	09/2015	<ul style="list-style-type: none"><li>Corrected Block Diagram.</li><li>Updated format.</li></ul>

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