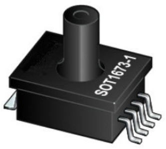
MPXM2051GS

Datasheet

50 kPa temperature compensated pressure sensor



MPXM2051GST1
Case 1320A

Features

- Ratiometric to supply voltage
- Available in easy-to-use Tape & Reel
- Temperature compensated over 0 °C to +85 °C
- Gauge ported

Applications

- Level indicators
- Medical diagnostics
- Robotics
- Pressure switching
- Pump/motor control
- Non-invasive blood pressure measurement

Description

The MPXM2051G device is a silicon piezoresistive pressure sensor providing a highly accurate and linear voltage output directly proportional to the applied pressure. The sensor is a single, monolithic silicon diaphragm with the strain gauge and a thin-film resistor network integrated on-chip. The chip is laser trimmed for precise span and offset calibration and temperature compensation.

1 Ordering information

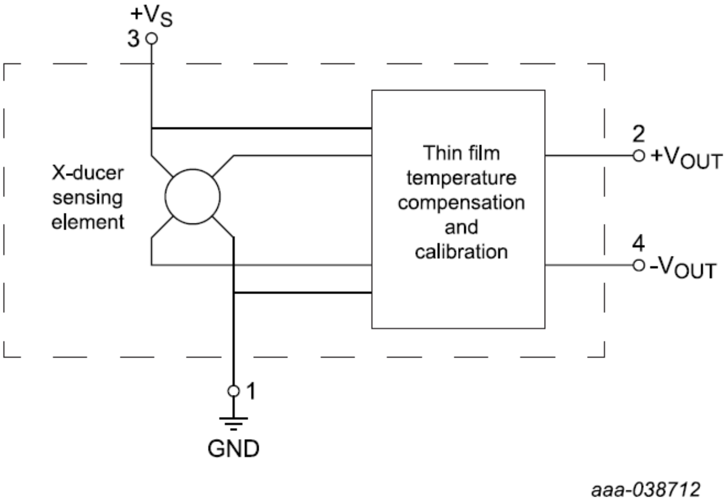
Table 1. Ordering options

ORDERING INFORMATION									
Device name	Package options	Case number	Number of ports			Pressure type			Device marking
			None	Single	Dual	Gauge	Differential	Absolute	
MPXM2051GST1	Tape and reel	1320A		●				●	MPXM2051GS

2 Block diagram

Figure 1 shows a block diagram of the internal circuitry on the stand-alone pressure sensor chip.

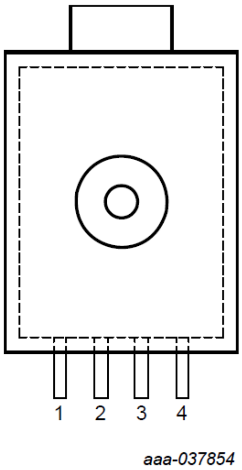
Figure 1. Temperature compensated pressure sensor schematic



3 Pin information

MPXM2051GST1

Figure 2. **MPXM2051G**



Symbol	Pin	Description
GND	1	Ground
$+V_{OUT}$	2	+ Voltage output
V_S	3	Power supply
$–V_{OUT}$	4	– Voltage output

4 Maximum ratings

Table 3. Maximum ratings

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

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
P_{MAX}	Overpressure	P1 > P2	—	—	200	kPa
T_{STG}	Storage Temperature	—	–40	—	+125	°C
T_A	Operating Temperature	—	–40	—	+125	°C

5 Operating characteristics

Table 4. Operating Characteristics (V_S = 10 Vdc, T_A = 25 °C unless otherwise noted, P1 > P2)

Characteristic	Symbol	Min	Typ	Max	Unit
Operating pressure range [1]	P_{OP}	0	—	50	kPa
Supply voltage [2]	V_S	—	10	16	Vdc
Supply current	I_o	—	6.0	—	mAdc
Full scale span[3]	V_{FSS}	38.5	40	41.5	mV
Offset [4]	V_{off}	–1.0	—	1.0	mV
Sensitivity	ΔV/ΔP	—	0.8	—	mV/kPa
Linearity [5]	—	–0.3	—	0.3	$\%V_{FSS}$
Pressure hysteresis (0 kPa to 50 kPa) [5]	—	—	±0.1	—	$\%V_{FSS}$
Temperature hysteresis (–40 °C to 125 °C) [5]	—	—	±0.5	—	$\%V_{FSS}$
Temperature coefficient of full scale span [5]	TCV_{FSS}	–1.0	—	1.0	$\%V_{FSS}$
Temperature coefficient of offset [5]	TCV_{off}	–1.0	—	1.0	mV
Input impedance	Z_{in}	1000	—	2500	Ω
Output impedance	Z_{out}	1400	—	3000	Ω
Response time (10 % to 90 %) [6]	t_R	—	1.0	—	ms
Warm up time[7]	—	—	20	—	ms
Offset stability [8]	—	—	±0.5	—	$\%V_{FSS}$

1. 1.0 kPa equals 0.145 PSI.
2. 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.
3. 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 related pressure.
4. Offset (V_{off}) is defined as the output voltage at the minimum rated pressure.
5. 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 °C to 85 °C, relative to 25 °C.
   TcOffset: Output deviation with minimum rated pressure applied, over the temperature range of 0 °C to 85 °C, relative to 25°C.
6. 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.
7. Warm-up time is defined as the time required for the product to meet the specified output voltage after the pressure has been stabilized.
8. Offset stability is the product's output deviation when subjected to 1000 hours of pulsed pressure, temperature cycling with bias test.

6 Characteristics

6.1 Voltage output versus applied differential pressure

The output voltage of the differential or gauge sensor increases with increasing pressure applied to the pressure side (P1) relative to the vacuum side (P2). Similarly, output voltage increases as increasing vacuum is applied to the vacuum side (P2) relative to the pressure side (P1).

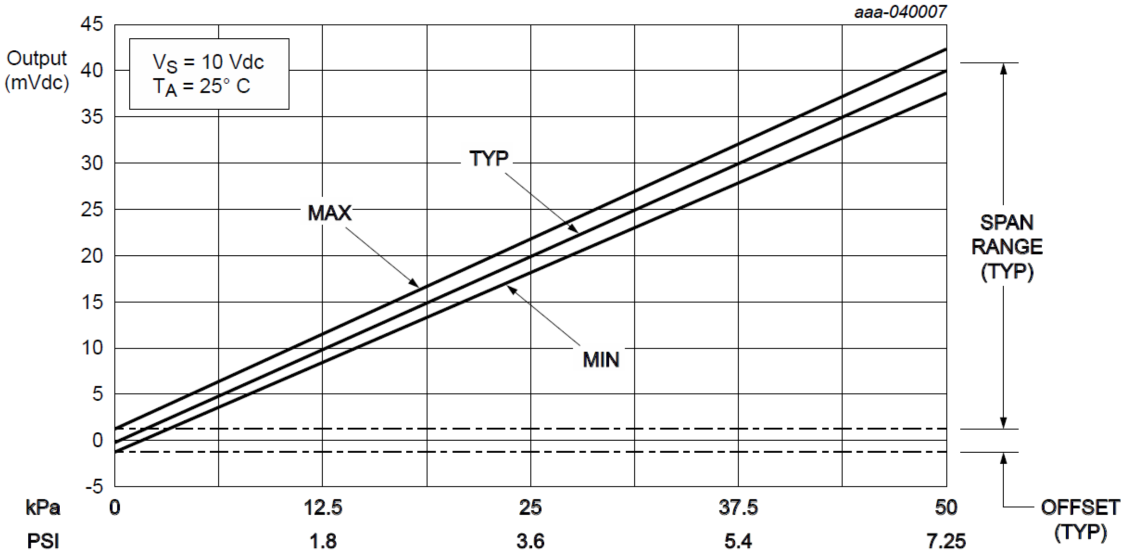
6.2 On-chip temperature compensation and calibration

Figure 3 shows the typical output characteristics of the MPXM2051G series at 25 °C.

The effects of temperature on full scale span and offset are very small and are shown under Section 8 "Operating characteristics".

This performance over temperature is achieved by having both the shear stress strain gauge and the thin-film resistor circuitry on the same silicon diaphragm. Each chip is dynamically laser trimmed for precise span and offset calibration and temperature compensation.

Figure 3. **Output vs. pressure differential**



6.3 Linearity

Linearity refers to how well a transducer's output follows the equation:

$V_{OUT} = V_{OFF}$ + Sensitivity x P over the operating pressure range (Figure 4).

There are two basic methods for calculating nonlinearity:

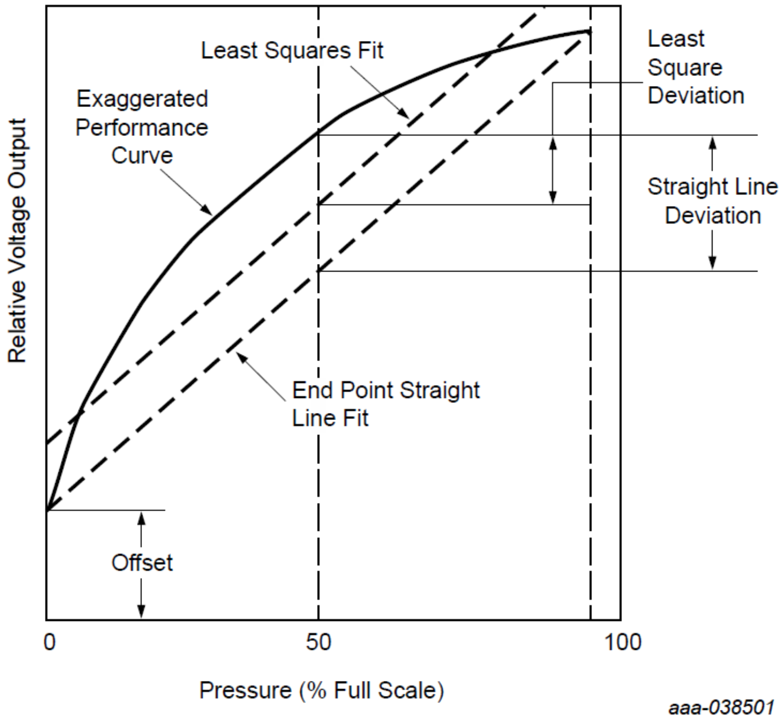
- End point straight line fit
- Least squares best line fit

While a least squares fit gives the "best case" linearity error (lower numerical value), the calculations required are burdensome.

Conversely, an end point fit will give the "worst case" error (often more desirable in error budget calculations) and the calculations are more straightforward for the user.

ST's specified pressure sensor linearities are based on the end point straight line method measured at the midrange pressure.

Figure 4. **Linearity specification comparison**



6.4 Pressure (P1) / vacuum (P2) side identifcation table

ST designates the two sides of the pressure sensor as the pressure (P1) side and the vacuum (P2) side. The pressure (P1) side is the side containing silicone gel, which isolates the die from the environment. ST's MPX pressure sensor is designed to operate with positive differential pressure applied, P1 > P2.

The pressure (P1) side may be identified by using Table 5.

Table 5. Pressure (P1) side identification table

Part Number	Case Type	Pressure (P1) Side Identifier
MPXM12GST1	1320A	Side with port attached

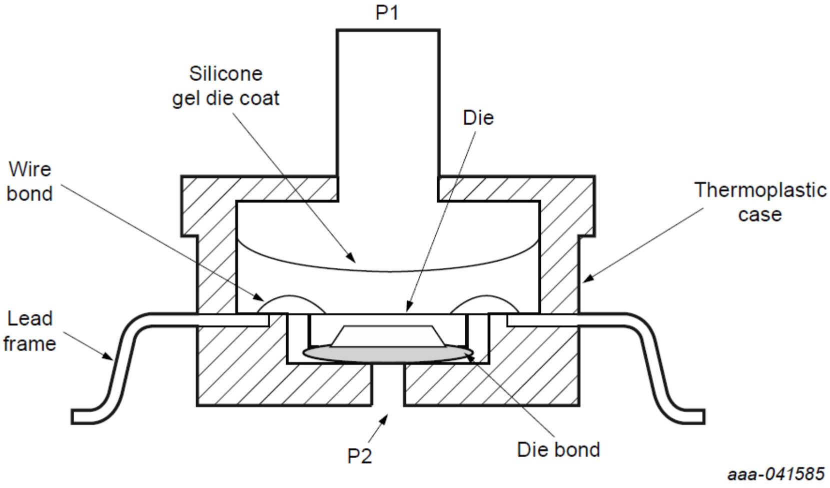
6.5 Media compatibilty

Figure 5 illustrates the gauge configuration in a typical chip carrier. A silicone gel isolates the die surface and wire bonds from the environment while allowing the pressure signal to be transmitted to the silicon diaphragm.

The MPXM2051G series pressure sensor operating characteristics, internal reliability and qualification tests are based on the use of dry clean air as the pressure medium. Media other than dry clean air may have adverse effects on sensor performance and long term reliability. Contact the factory for information regarding media compatibility in your application.

For more information, refer to application note AN3728 [5] .

Figure 5. **MPAK package — cross-sectional diagram (not to scale)**

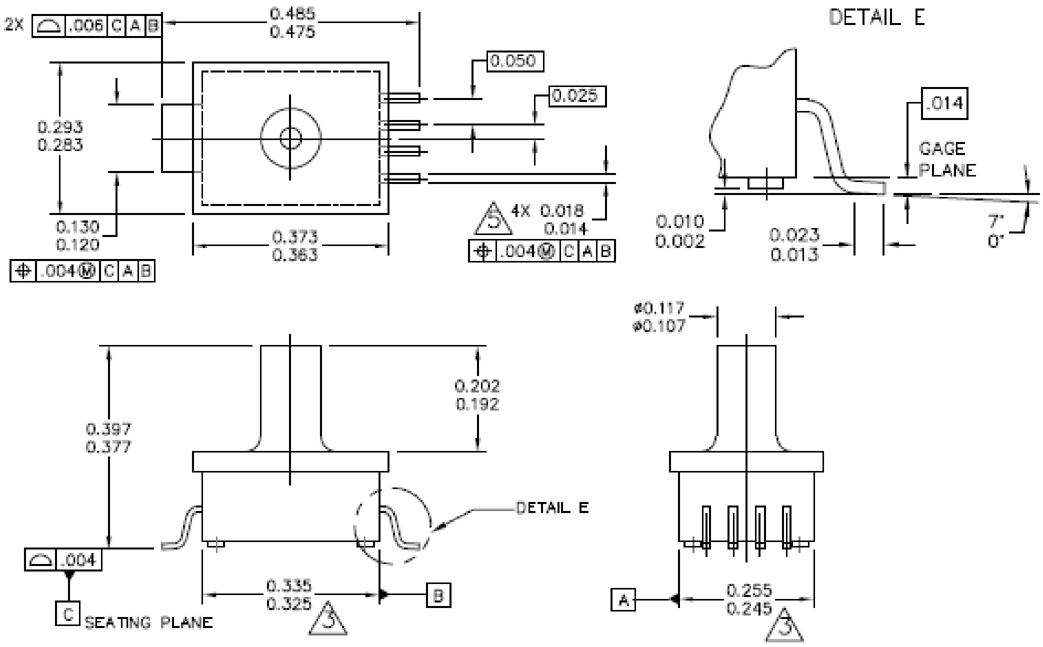


7 Package outlines

Package dimensions are provided in package drawings. To find the most current package outline drawing, go to https://www.st.com/ and perform a keyword search for the drawing's document number.

7.1 MPAK packages

Figure 6. **SOT1673-1 (98ARH99087A) package outline**



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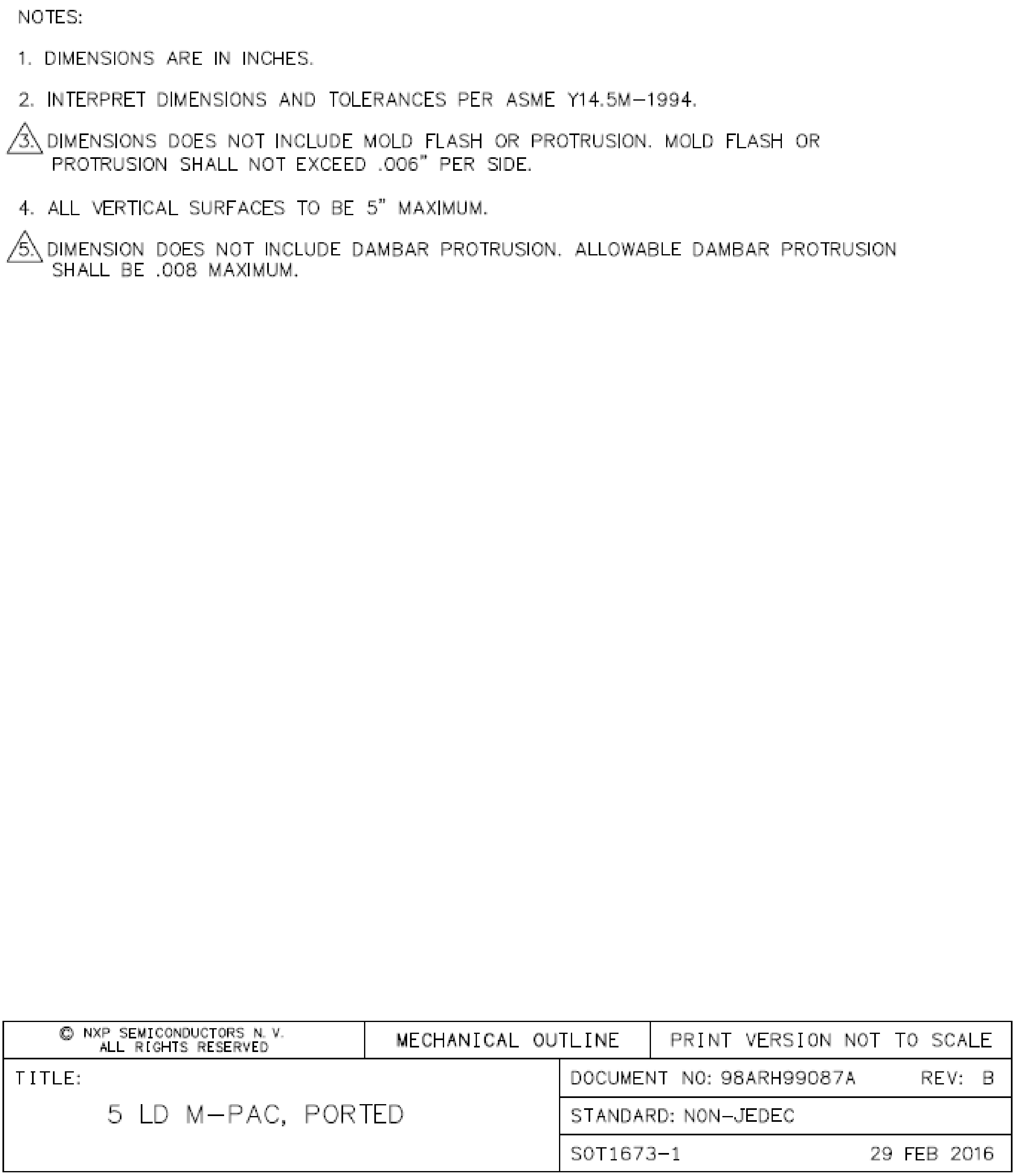
TITLE: 5 LD M—PAC, PORTED	DOCUMENT NO: 98ARH99087A	REV: B
	STANDARD: NON—JEDEC	
	SOT1673—1	29 FEB 2016

Figure 7. SOT1673-1 (98ARH99087A) package outline notes



NOTES:

1. DIMENSIONS ARE IN INCHES.

2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M−1994.

△3. DIMENSIONS DOES NOT INCLUDE MOLD FLASH OR PROTRUSION. MOLD FLASH OR PROTRUSION SHALL NOT EXCEED .006" PER SIDE.

4. ALL VERTICAL SURFACES TO BE 5" MAXIMUM.

△5. DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .008 MAXIMUM.

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TITLE: 5 LD M−PAC, PORTED	DOCUMENT NO: 98ARH99087A	REV: B
	STANDARD: NON−JEDEC	
	SOT1673−1	29 FEB 2016

Figure 7. SOT1673-1 (98ARH99087A) package outline notes

Revision history

Table 1. **Document revision history**

Date	Revision	Changes
23-Jun-2026	1	Initial release from ST, rebranded NXP document.

Contents

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