

MPX4250D

0 to 250 kPa, Differential, gauge pressure sensor, on-chip
signal conditioned, temperature compensated and calibrated

Rev. 8.0 — 25 July 2017

Data sheet: technical data

1 General description

The MPX4250D series piezoresistive transducer is a state-of-the-art monolithic silicon pressure sensor designed for a wide range of applications, particularly those employing a microcontroller or microprocessor with A/D inputs. This transducer combines advanced micromachining techniques, thin-film metallization, and bipolar processing to provide an accurate, high-level analog output signal that is proportional to the applied pressure. The small form factor and high reliability of on-chip integration make the NXP sensor a logical and economical choice for the automotive system engineer.

2 Features

- Differential and gauge applications available
- 1.4 % maximum error over 0 °C to 85 °C
- Patented silicon shear stress strain gauge
- Temperature compensated over –40 °C to +125 °C
- Offers reduction in weight and volume compared to existing hybrid modules
- Durable epoxy unibody element
- Available in two unibody packages

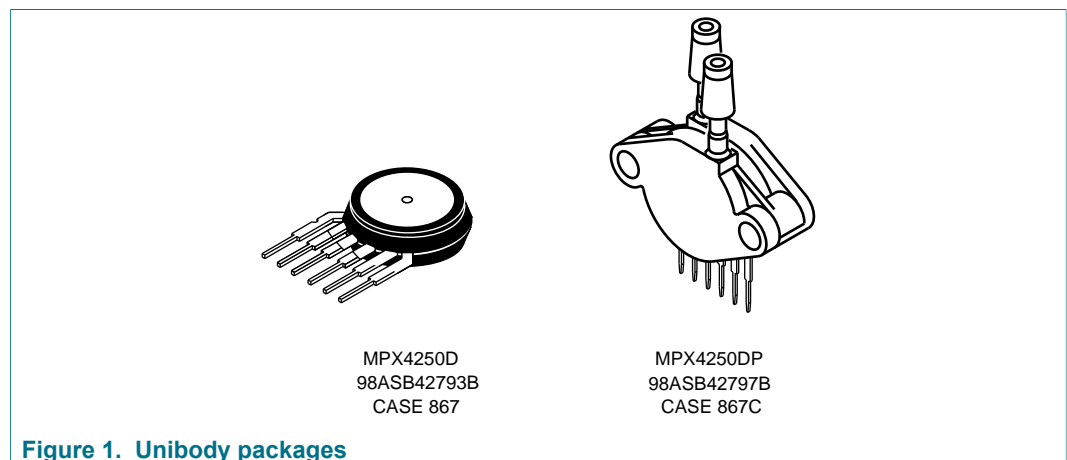


Figure 1. Unibody packages

3 Typical applications

- Ideally suited for microprocessor or microcontroller-based systems

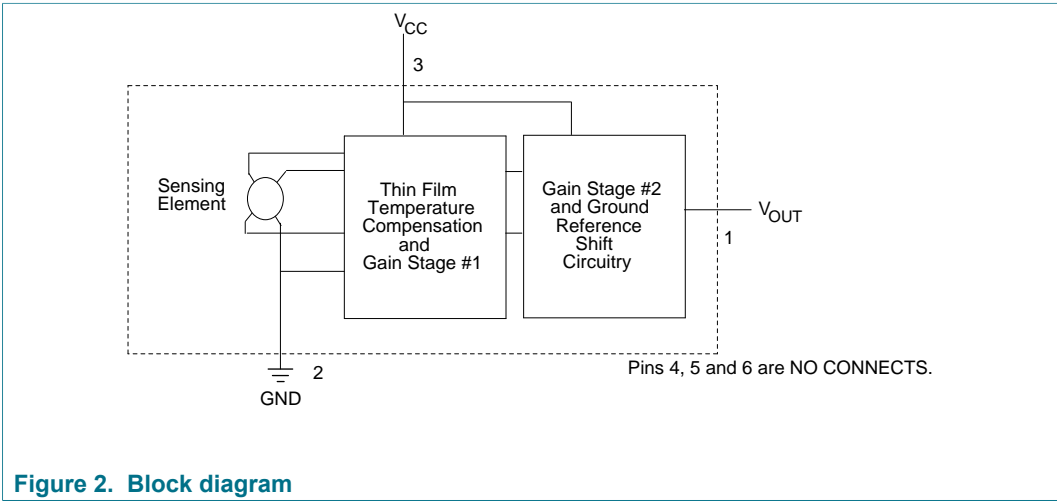


4 Ordering information

Table 1. Ordering information

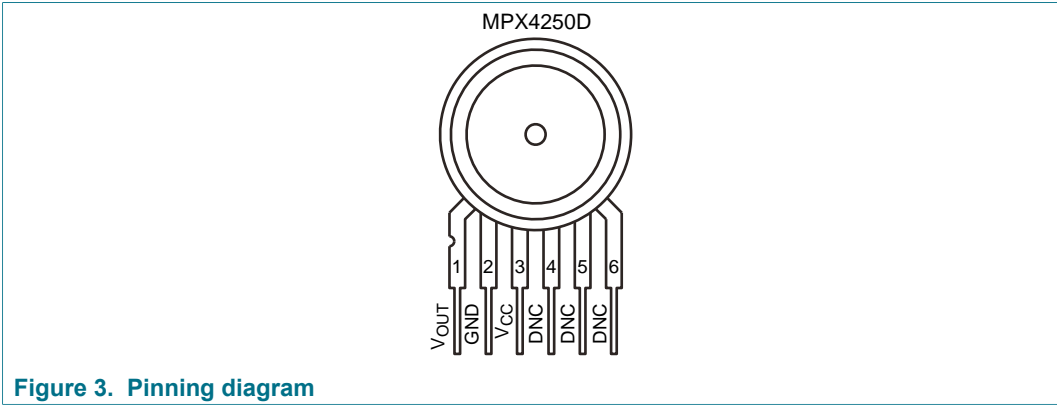
Device name	Package Options	Package Name	# of Ports			Pressure type			Device marking
			None	Single	Dual	Gauge	Differential	Absolute	
MPX4250D	Tray	98ASB42793B	•				•		MPX4250D
MPX4250DP	Tray	98ASB42797B			•		•		MPX4250DP

5 Block diagram



6 Pinning information

6.1 Pinning



0 to 250 kPa, Differential, gauge pressure sensor, on-chip signal conditioned, temperature compensated and calibrated

6.2 Pin description

Table 2. Pin descriptions

Symbol	Pin	Description
V _{OUT}	1	Output voltage
GND	2	Ground
V _{CC}	3	Voltage supply
DNC	4	Do not connect to external circuitry or ground
DNC	5	Do not connect to external circuitry or ground
DNC	6	Do not connect to external circuitry or ground

7 Mechanical and electrical specifications

7.1 Maximum ratings

Table 3. Maximum ratings

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

Rating	Symbol	Value	Unit
Maximum pressure (P ₁ > P ₂)	P _{MAX}	1000	kPa
Storage temperature	T _{STG}	−40 to +125	°C
Operating temperature	T _A	−40 to +125	°C

Figure 2 shows a block diagram of the internal circuitry integrated on a pressure sensor chip.

7.2 Operating characteristics

Table 4. Operating characteristics

(V_{CC} = 5.1 Vdc, T_A = 25 °C unless otherwise noted, P₁ > P₂. Decoupling circuit shown in Figure 5 required to meet electrical specifications.)

Symbol	Characteristic	Min	Typ	Max	Unit
P _{OP}	Pressure range ^[1]	0	—	250	kPa
V _{CC}	Supply voltage ^[2]	4.85	5.1	5.35	Vdc
I _o	Supply current	—	7.0	10	mAdc
V _{off}	Minimum pressure offset ^[3] (0 °C to 85 °C)	0.139	0.204	0.269	Vdc
V _{FSO}	Full scale output ^[4] (0 °C to 85 °C)	4.844	4.909	4.974	Vdc
V _{FSS}	Full scale span ^[5] (0 °C to 85 °C)	—	4.705	—	Vdc
—	Accuracy ^[6] (0 °C to 85 °C)	—	—	±1.4	%V _{FSS}
ΔV/ΔP	Sensitivity	—	18.8	—	mV/kPa
t _R	Response time ^[7]	—	1.0	—	ms
I _{o+}	Output source current at full scale output	—	0.1	—	mAdc

0 to 250 kPa, Differential, gauge pressure sensor, on-chip signal conditioned, temperature compensated and calibrated

Symbol	Characteristic	Min	Typ	Max	Unit
—	Warm-up time ^[8]	—	20	—	ms
—	Offset stability ^[9]	—	± 0.5	—	%V _{FSS}

- [1] 1.0 kPa (kiloPascal) equals 0.145 psi.
- [2] Device is ratiometric within this specified excitation range.
- [3] Offset (V_{off}) is defined as the output voltage at the minimum rated pressure.
- [4] Full scale output (V_{FSO}) is defined as the output voltage at the maximum or full rated pressure.
- [5] 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.
- [6] Accuracy (error budget) consists of the following:
- Linearity: Output deviation from a straight line relationship with pressure 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 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 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.
- Variation from nominal: The variation from nominal values, for offset or full scale span, as a percent of V_{FSS} , at 25 °C.
- [7] 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.
- [8] Warm-up time is defined as the time required for the product to meet the specified output voltage after the pressure has been stabilized.
- [9] Offset stability is the product's output deviation when subjected to 1000 hours of pulsed pressure, temperature cycling with bias test.

8 On-chip temperature compensation and calibration

Figure 4 illustrates the differential/gauge pressure sensing chip in the basic chip carrier (98ASB42793B). A fluorosilicone gel isolates the die surface and wire bonds from the environment, while allowing the pressure signal to be transmitted to the sensor diaphragm.

The MPX4250D series pressure sensor operating characteristics and internal reliability and qualification tests are based on use of dry air as the pressure media. Media, other than dry air, may have adverse effects on sensor performance and long-term reliability. Contact the factory for information regarding media compatibility in your application.

Figure 5 shows the recommended decoupling circuit for interfacing the output of the integrated sensor to the A/D input of a microprocessor or microcontroller.

Figure 6 shows the sensor output signal relative to pressure input. Typical, minimum, and maximum output curves are shown for operation over a temperature range of 0 °C to 85 °C using the decoupling circuit shown in Figure 5. The output will saturate outside of the specified pressure range.

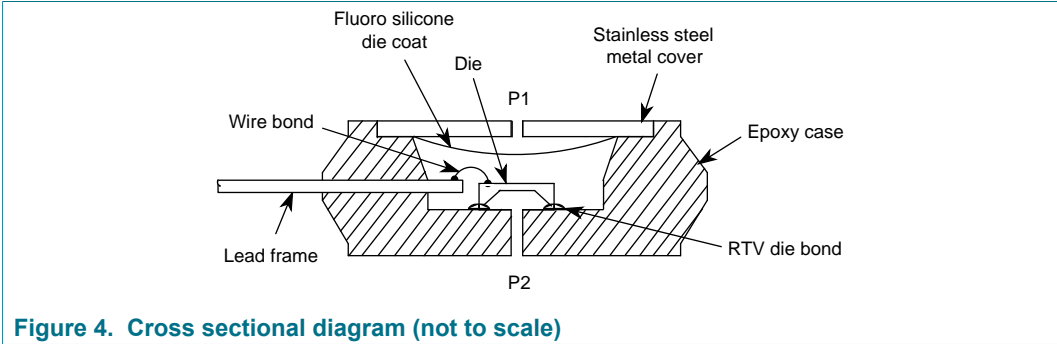
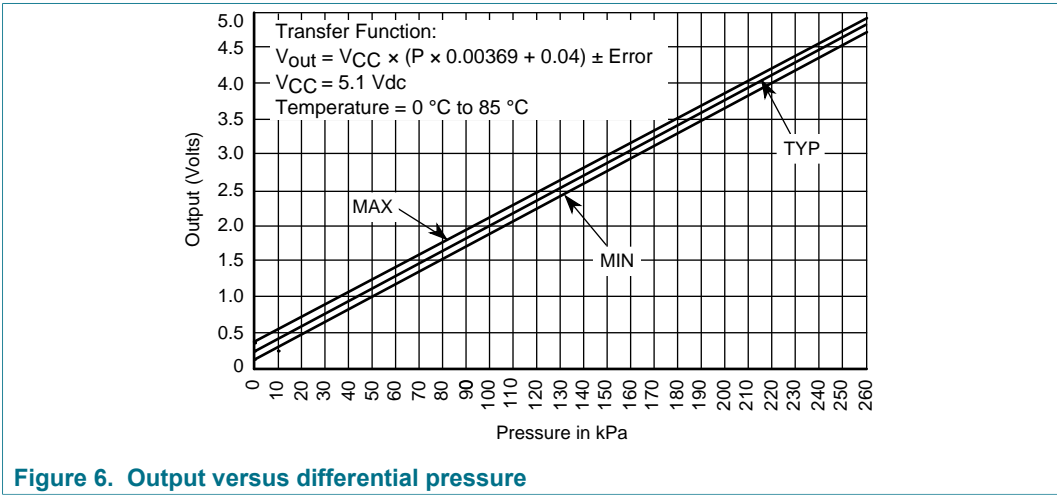
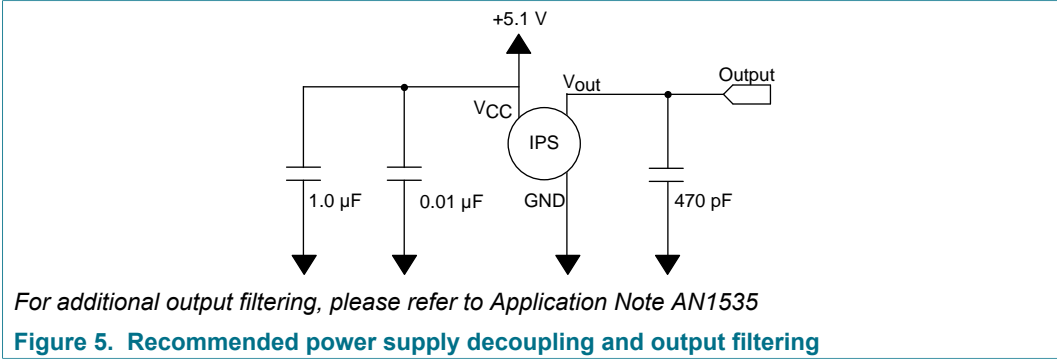


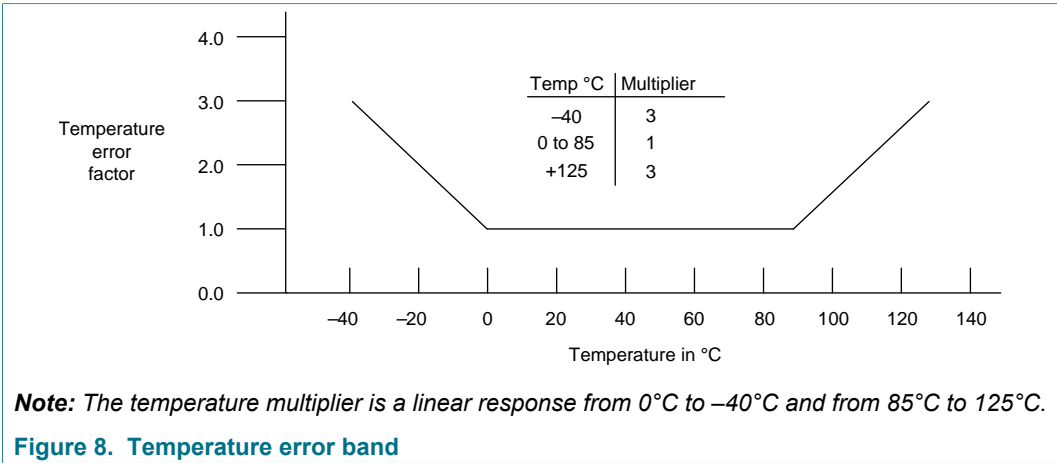
Figure 4. Cross sectional diagram (not to scale)

0 to 250 kPa, Differential, gauge pressure sensor, on-chip signal conditioned, temperature compensated and calibrated

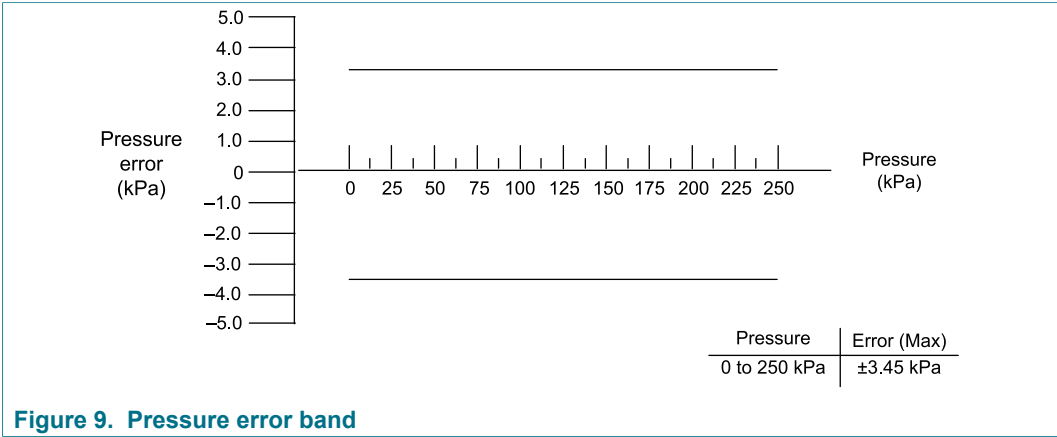


Nominal transfer value: $V_{OUT} = V_{CC} \times (P \times 0.00369 + 0.04) \pm (\text{Pressure Error} \times \text{Temp. Factor} \times 0.00369 \times V_{CC})$
 $V_{CC} = 5.1 \pm 0.25 \text{ Vdc}$

Figure 7. Transfer function

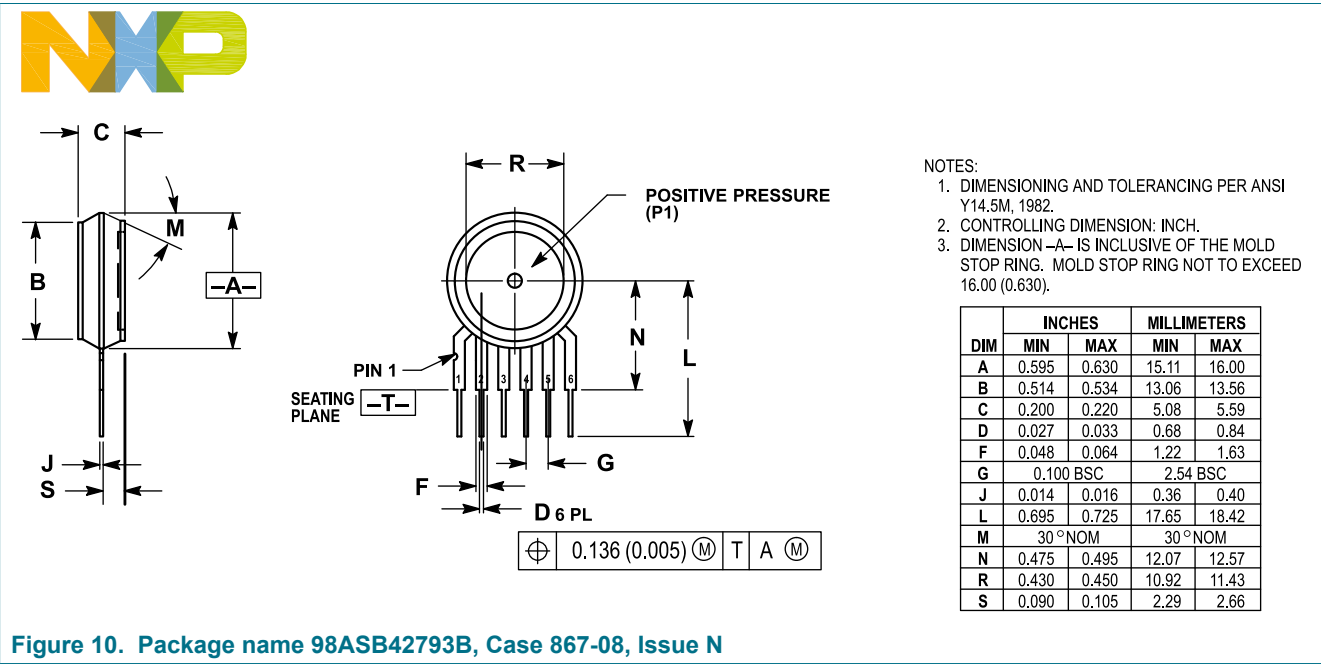


0 to 250 kPa, Differential, gauge pressure sensor, on-chip signal conditioned, temperature compensated and calibrated



9 Package information

9.1 Package description



0 to 250 kPa, Differential, gauge pressure sensor, on-chip signal conditioned, temperature compensated and calibrated

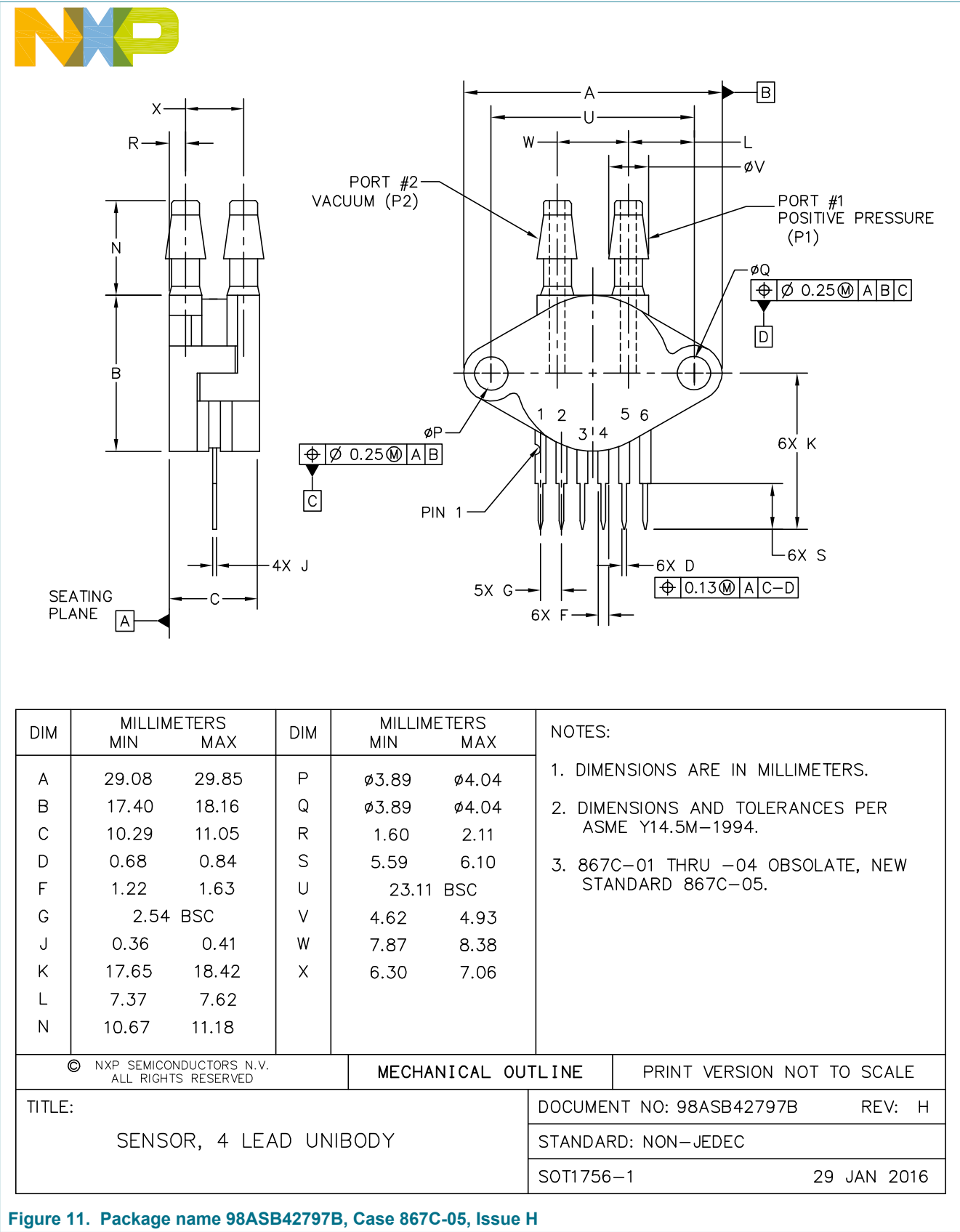
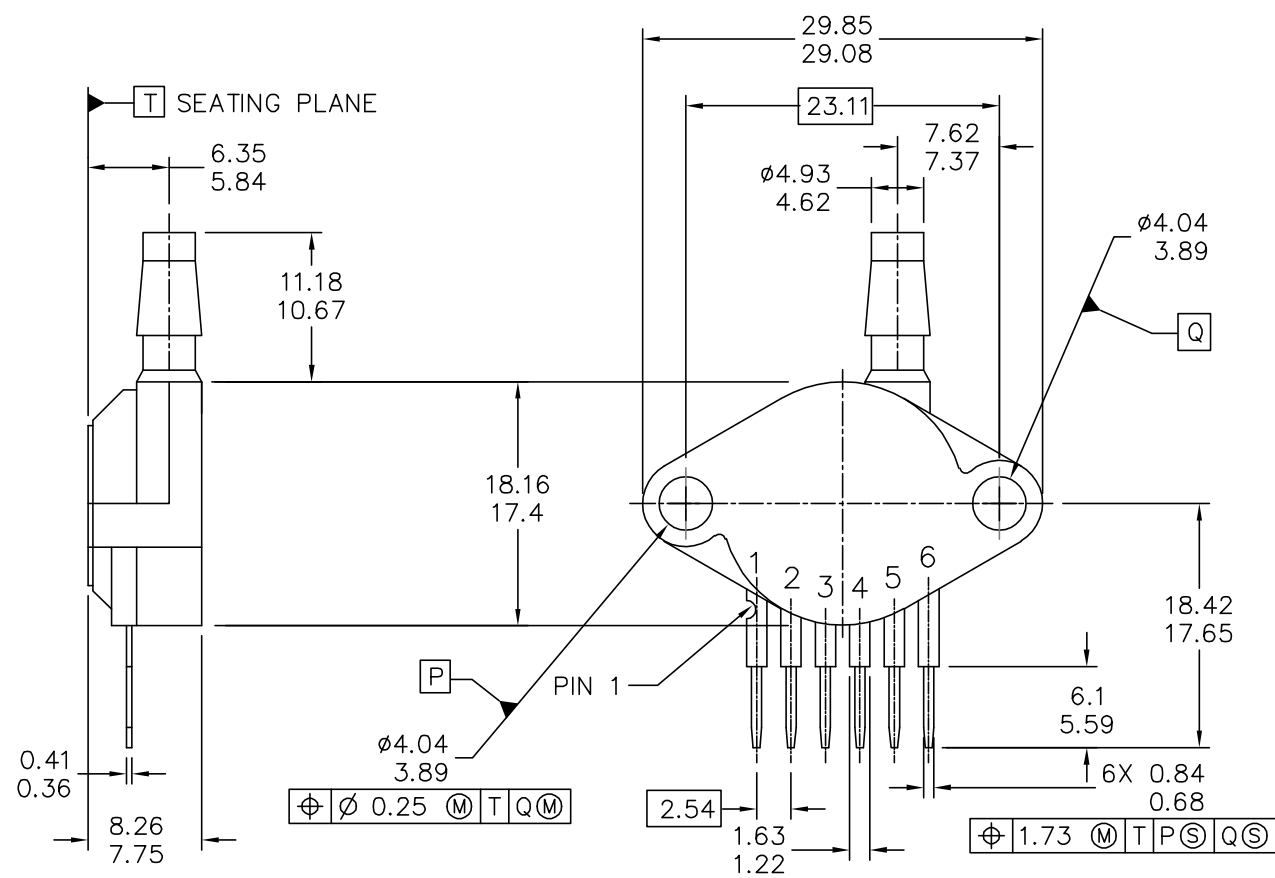


Figure 11. Package name 98ASB42797B, Case 867C-05, Issue H

0 to 250 kPa, Differential, gauge pressure sensor, on-chip signal conditioned, temperature compensated and calibrated



© NXP SEMICONDUCTORS N.V. ALL RIGHTS RESERVED	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
TITLE: SENSOR, 6 LEAD UNIBODY CELL, AP & GP 01ASB09087B	DOCUMENT NO: 98ASB42796B	REV: J
	STANDARD: NON-JEDEC	
	SOT1852-1	15 MAR 2016

0 to 250 kPa, Differential, gauge pressure sensor, on-chip signal conditioned, temperature compensated and calibrated



- NOTES:
- 1. DIMENSIONS ARE IN MILLIMETERS.
 - 2. DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
 - 3. 867B-01 THRU -3 OBSOLETE, NEW STANDARD 867B-04.

© NXP SEMICONDUCTORS N.V. ALL RIGHTS RESERVED	MECHANICAL OUTLINE	PRINT VERSION NOT TO SCALE
TITLE: SENSOR, 6 LEAD UNIBODY CELL, AP & GP 01ASB09087B	DOCUMENT NO: 98ASB42796B REV: J	
	STANDARD: NON-JEDEC	
	SOT1852-1	15 MAR 2016

Figure 12. Package name 98ASB42796B, Case 867B-04, Issue J

10 Revision history

Table 5. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
MPX4250D v.8.0	20170725	Technical data	—	MPX4250 v.7.0
Modifications:	<ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. Legal texts have been adapted to the new company name where appropriate. Revised "MPX4250" to "MPX4250D." Updated the document title from "Integrated Silicon Pressure Sensor Manifold Absolute Pressure Sensor On-Chip Signal Conditioned, Temperature Compensated and Calibrated" to "0 to 250 kPa, Manifold absolute pressure sensor, on-chip signal conditioned, temperature compensated and calibrated." Added Figure 1 "Unibody packages" in Section 2 "Features". Updated Table 1 "Ordering information" in Section 4 "Ordering information". Revised Figure 2 "Block diagram" in Section 5 "Block diagram" as follows: <ul style="list-style-type: none"> Changed V_S to V_{CC} Revised the note to read "Pins 4, 5 and 6 are NO CONNECTS" Added pinning illustration as Figure 3 "Pinning diagram" in Section 6.1 "Pinning". Added pin descriptions in Table 2 "Pin descriptions" in Section 6.2 "Pin description". Changed V_S to V_{CC} in the description and within the body of Table 4 "Operating characteristics" in Section 7.2 "Operating characteristics". Updated the figures in Section 8 "On-chip temperature compensation and calibration" as follows: <ul style="list-style-type: none"> Figure 4 "Cross sectional diagram (not to scale)" Figure 5 "Recommended power supply decoupling and output filtering" Figure 6 "Output versus differential pressure" Figure 7 "Transfer function" Figure 9 "Pressure error band" Updated the figures and figure titles in Section 9.1 "Package description" as follows: <ul style="list-style-type: none"> Figure 10 "Package name 98ASB42793B, Case 867-08, Issue N" Figure 11 "Package name 98ASB42797B, Case 867C-05, Issue H" Figure 12 "Package name 98ASB42796B, Case 867B-04, Issue J" 			
MPX4250 v.7.0	20090131	Technical data	—	MPX4250 v.6.0

11 Legal information

11.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
[short] Data sheet: product_preview	Development	This document contains certain information on a product under development. NXP reserves the right to change or discontinue this product without notice.
[short] Data sheet: advance information	Qualification	This document contains information on a new product. Specifications and information herein are subject to change without notice.
[short] Data sheet: technical data	Production	This document contains the product specification. NXP Semiconductors reserves the right to change the detail specifications as may be required to permit improvements in the design of its products.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices.

11.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a technical data data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the technical data data sheet.

11.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors. In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory. Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without

limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification. Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products. NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nxp.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Suitability for use in automotive applications — This NXP Semiconductors product has been qualified for use in automotive

0 to 250 kPa, Differential, gauge pressure sensor, on-chip signal conditioned, temperature compensated and calibrated

applications. Unless otherwise agreed in writing, the product is not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

11.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

Freescale — is a trademark of NXP B.V.

NXP — is a trademark of NXP B.V.

Tables

Tab. 1.	Ordering information	2	Tab. 4.	Operating characteristics	3
Tab. 2.	Pin descriptions	3	Tab. 5.	Revision history	10
Tab. 3.	Maximum ratings	3			

Figures

Fig. 1.	Unibody packages	1	Fig. 8.	Temperature error band	5
Fig. 2.	Block diagram	2	Fig. 9.	Pressure error band	6
Fig. 3.	Pinning diagram	2	Fig. 10.	Package name 98ASB42793B, Case 867-08, Issue N	6
Fig. 4.	Cross sectional diagram (not to scale)	4	Fig. 11.	Package name 98ASB42797B, Case 867C-05, Issue H	7
Fig. 5.	Recommended power supply decoupling and output filtering	5	Fig. 12.	Package name 98ASB42796B, Case 867B-04, Issue J	8
Fig. 6.	Output versus differential pressure	5			
Fig. 7.	Transfer function	5			

Contents

1 General description 1

2 Features 1

3 Typical applications 1

4 Ordering information 2

5 Block diagram 2

6 Pinning information 2

6.1 Pinning 2

6.2 Pin description 3

7 Mechanical and electrical specifications 3

7.1 Maximum ratings 3

7.2 Operating characteristics 3

8 On-chip temperature compensation and calibration 4

9 Package information 6

9.1 Package description 6

10 Revision history 10

11 Legal information 11