MPX2053D, MPXV2053DP
MPXM2053D, MPXM2053GS

Datasheet

50 kPa temperature compensated pressure sensors

MPX2053D
Case 344-15

MPXV2053DP
Case 1351-01

MPXM2053DT1
Case 1320-02

MPXM2053GS/GST1
Case 1320A-02

Features

- Ratiometric to Supply Voltage
- Differential and Gauge Options
- Temperature Compensated over 0 °C to 85 °C
- Easy-to-Use Chip Carrier Package Options

Applications

- Level Indicators
- Medical Diagnostics
- Robotics
- Pressure Switching
- Pump/Motor Controllers
- Non-Invasive Blood Pressure Measurement

Description

The MPX2053 series devices are silicon piezoresistive pressure sensors that provide 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

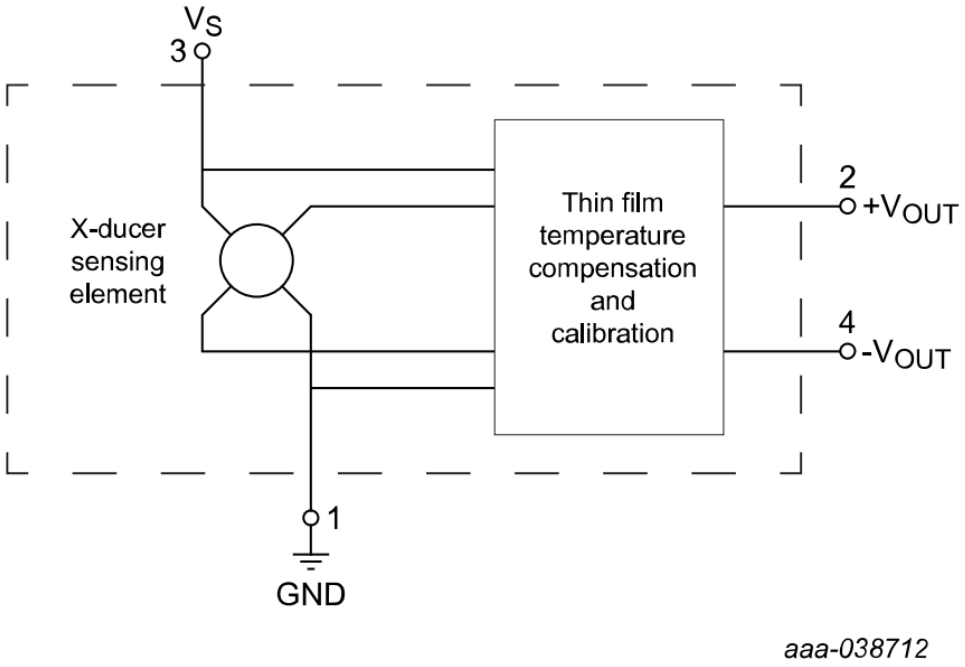
Table 1. **Ordering information**

Device Name	Package options	Case number	Gauge	Differential	Absolute	Device marking
MPXV2053DP	Tray	1351		•		MPXV2053DP
MPX2053D	Tray	344		•		MPX2053D
MPXM2053DT1	Tape & Reel	1320		•		MPXM2053D
MPXM2053GS	Tube	1320A		•		MPXM2053GS
MPXM2053GST1	Tape & Reel	1320A		•		MPXM2053GS

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

MPX2053D

Figure 2. **Case 344-15**

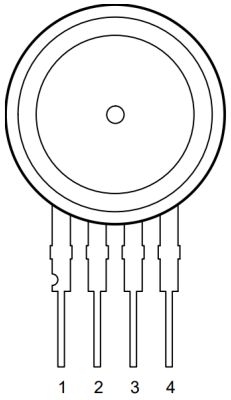


Table 2. **Pin definitions – MPX2053D**

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

MPXM2053GS/GST1

Figure 3. **Case 1320A-02**

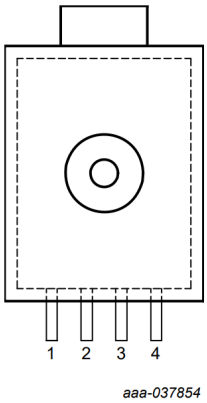


Table 3. **Pin definitions – MPXM2053GS/GST1**

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

MPXV2053DP

Figure 4. **CASE 1351-01**

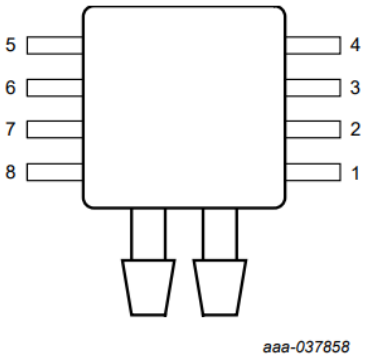


Table 4. **Pin definitions – MPXV2053DP**

Symbol	Pin	Description
GND	1	Ground
$+V_{OUT}$	2	+ Voltage output
V_S	3	Power supply
$-V_{OUT}$	4	- Voltage output
n.a.	5	—
n.a.	6	—
n.a.	7	—
n.a.	8	—

MPXM2053DT1

Figure 5. **Case 1320-02**

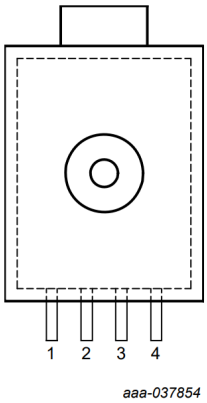


Table 5. **Pin definitions - MPXM2053DT1**

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

4 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).

Table 6. Maximum ratings

Symbol	Parameter	Conditions	Min	Typ	Max
P_{max}	Overpressure	P1 > P2			200 kPa
T_{stg}	Storage Temperature		-40 °C		+125 °C
T_A	Operating Temperature		-40 °C		+125 °C

5 Operating Characteristics

Table 7. Operating Characteristics (VS = 10.0 Vdc, TA = 25 °C unless otherwise noted, P1 > P2)

Characteristic		Symbol	Min	Typ	Max
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)	—	-0.6	—	0.4 %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}	-2.0	—	2.0 %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 (VFSS) is defined as the algebraic difference between the output voltage at full rated pressure and the output voltage at the minimum rated pressure.*
4. *Offset (Voff) is defined as the output voltage at the minimum rated pressure.*
5. *Accuracy (error budget) consists of linearity, temperature hysteresis, pressure hysteresis, TcSpan, and TcOffset as described in the source datasheet.*
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

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).

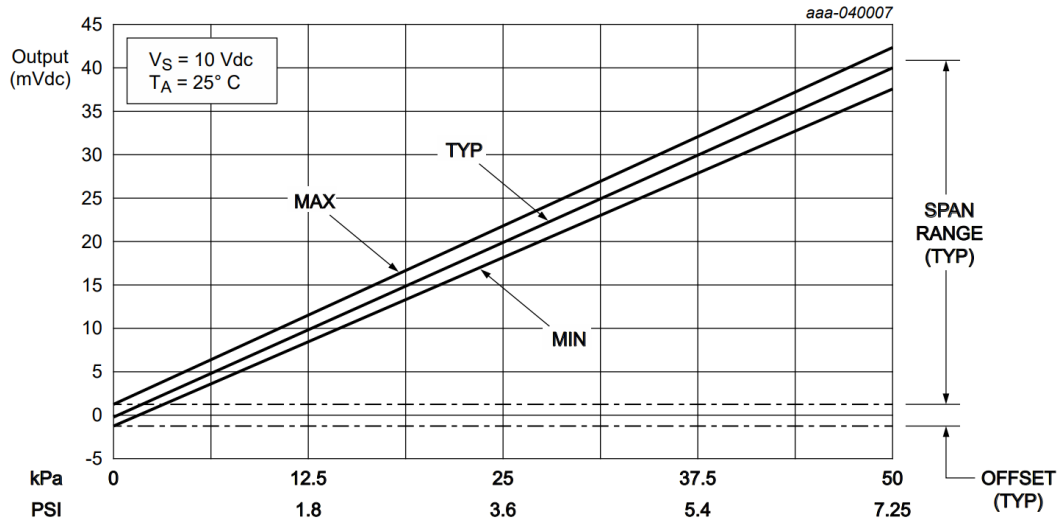
On-chip temperature compensation and calibration

Figure 6 shows the typical output characteristics of the MPX2053 series at 25 °C.

The effects of temperature on full scale span and offset are very small and are shown under 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 6. Output vs. pressure differential



Linearity

Linearity refers to how well a transducer's output follows the equation $V_{out} = V_{off}$ + Sensitivity × P over the operating pressure range Figure 7.

There are two basic methods for calculating nonlinearity:

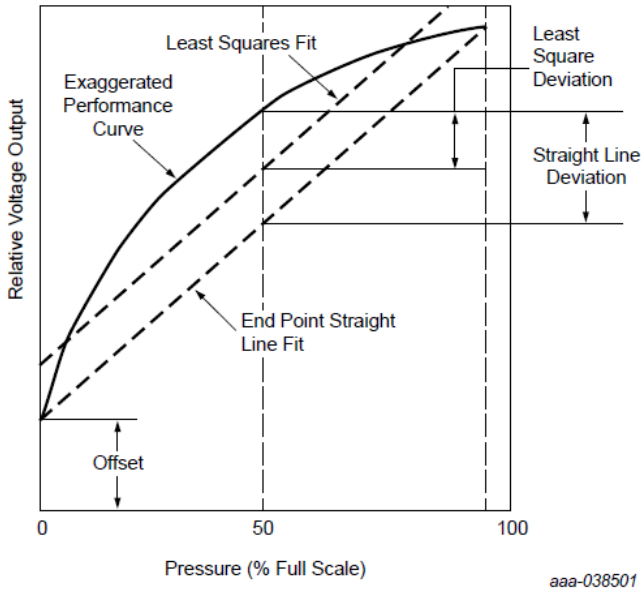
- End point straight line fit
- Least squares best line fit

While a least squares fit gives the best case linearity error, the calculations required are burdensome.

Conversely, an end point fit gives the worst case error 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 7. **Linearity specification comparison**



Pressure (P1) / Vacuum (P2) side identification

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 that isolates the die from the environment. The ST MPX pressure sensor is designed to operate with positive differential pressure applied, P1 > P2.

The Pressure (P1) side may be identified by using the following table.

Table 8. **Pressure (P1) side delineation table**

Part Number	Case Type	Pressure (P1) Side Identifier
MPX2053D	344	Stainless Steel Cap
MPXV2053DP	1351	Side with Part Marking
MPXM2053DT1	1320	Side with Part Marking
MPXM2053GS/GST1	1320A	Side with Port Attached

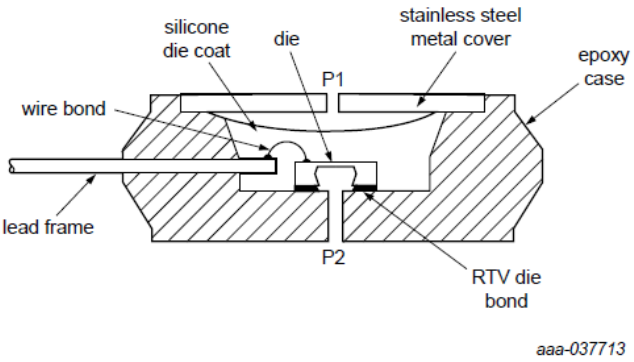
Media compatibility

Figure 8 illustrates the differential or 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 MPX2053 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.

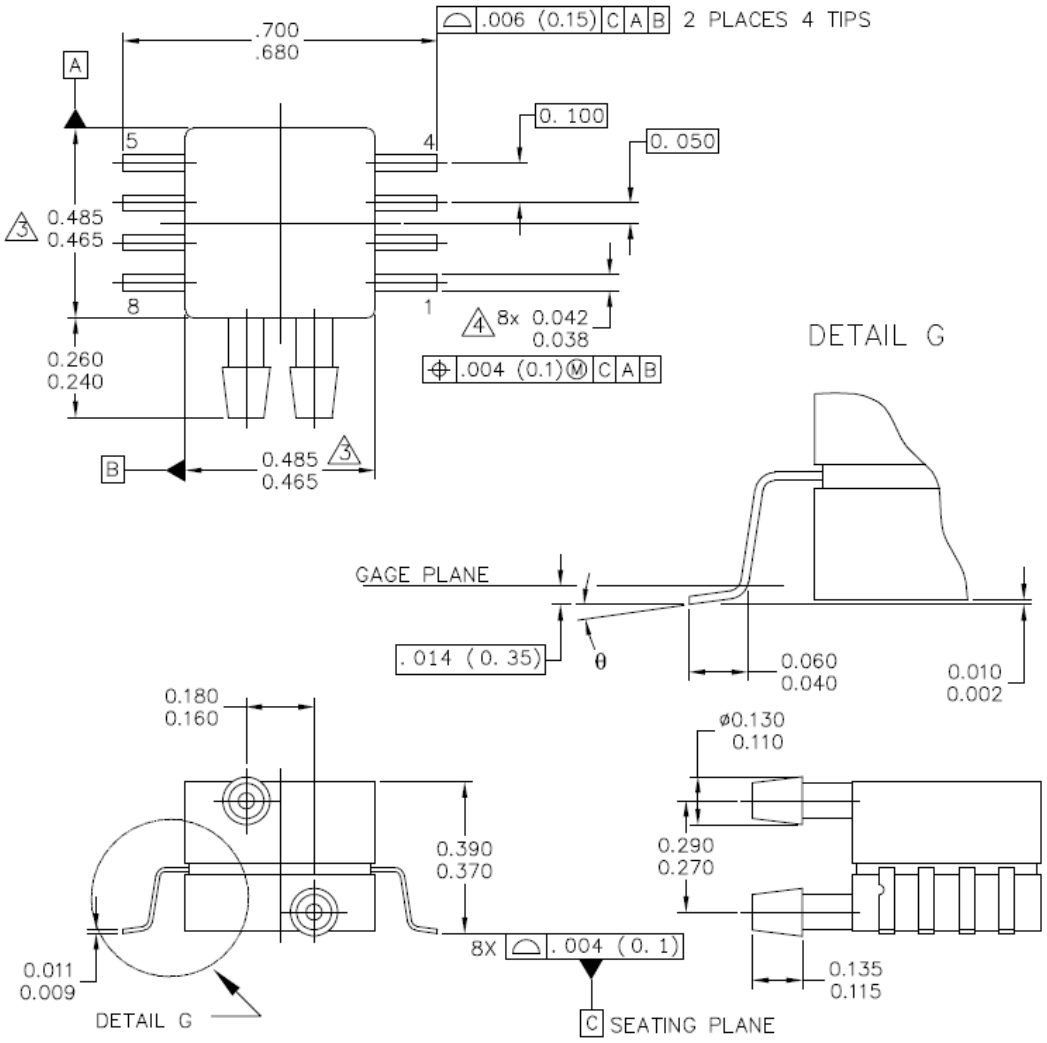
Figure 8. Unibody package — cross-sectional diagram (not to scale)



7 Package Outlines

Small outline packages

Figure 9. **SOT1693-1 (Case 1351) – Page 1**



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	STANDARD: NON-JEDEC	
	SOT1693-1	14 MAR 2016

Figure 10. **SOT1693-1 (Case 1351) – Page 2**

NOTES:

1. CONTROLLING DIMENSION: INCH

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

3. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PPROTRUSIONS.
MOLD FLASH AND PROTRUSIONS SHALL NOT EXCEED .006 PER SIDE.

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

STYLE 1:	STYLE 2:
PIN 1: GND	PIN 1: N/C
PIN 2: +Vout	PIN 2: Vs
PIN 3: Vs	PIN 3: GND
PIN 4: –Vout	PIN 4: Vout
PIN 5: N/C	PIN 5: N/C
PIN 6: N/C	PIN 6: N/C
PIN 7: N/C	PIN 7: N/C
PIN 8: N/C	PIN 8: N/C

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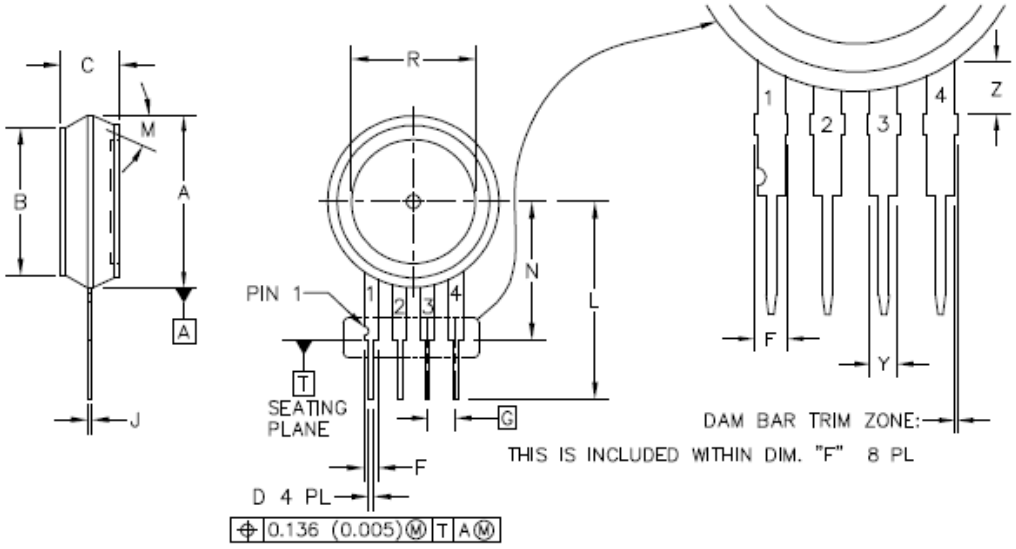
Unibody packages

Figure 11. **SOT1772-1 (Case 344-15)**



DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	15.11	16.00	0.595	0.630
B	13.06	13.56	0.514	0.534
C	5.08	5.59	0.200	0.220
D	0.41	0.51	0.016	0.020
F	1.22	1.63	0.048	0.064
G	2.54 BSC		0.100 BSC	
J	0.36	0.40	0.014	0.016
L	17.65	18.42	0.695	0.725
M	30° NOM		30° NOM	
N	12.07	12.57	0.475	0.495
R	10.92	11.43	0.430	0.450
Y	1.22	1.32	0.048	0.052
Z	2.68	3.00	0.106	0.118

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION A IS INCLUSIVE OF THE MOLD STOP RING NOT TO EXCEED 16.00 (0.630)
4. 344–01 THRU –4 OBSOLETE.
5. 344–05 THRU –11 OBSOLETE, NEW STANDARD 344–15.

STYLE 1:
PIN 1. GROUND
2. + OUTPUT
3. + SUPPLY
4. – OUTPUT

STYLE 2:
PIN 1. VCC
2. – SUPPLY
3. + SUPPLY
4. GROUND

STYLE 3:
PIN 1. GROUND
2. – VOUT
3. VS
4. + VOUT

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	STANDARD: NON–JEDEC	
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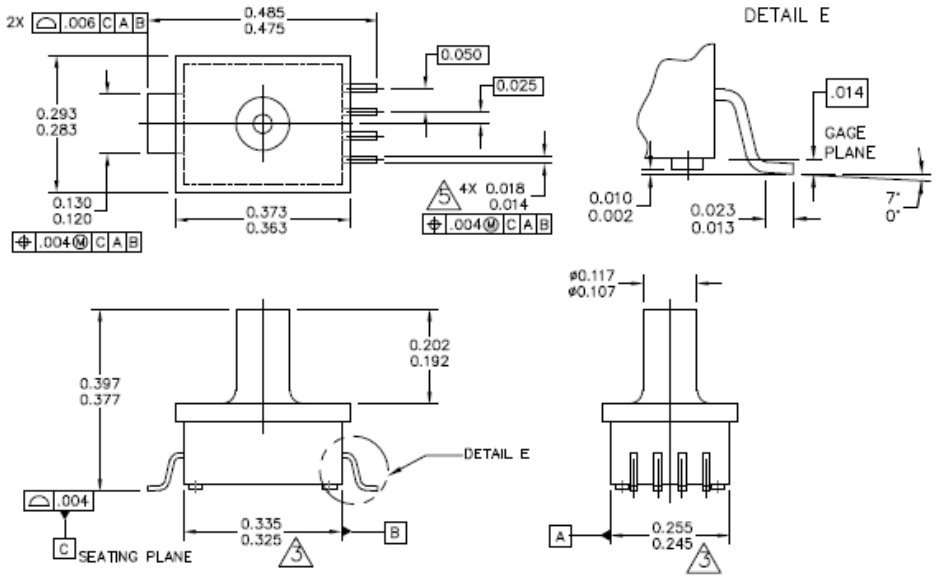
MPAK packages

Figure 12. **SOT1673-1 (1320A-02) – Page 1**



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	SOT1673–1	29 FEB 2016

Figure 13. **SOT1673-1 (1320A-02) – Page 2**

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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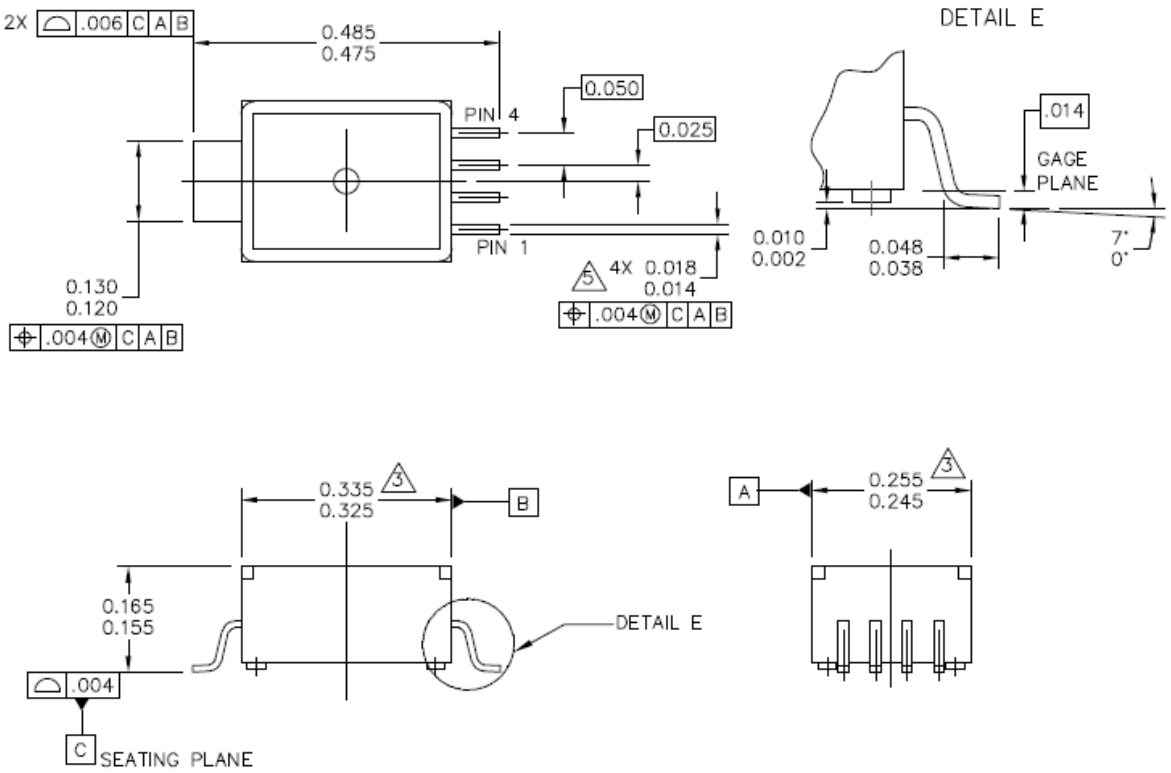
Figure 14. **SOT1674-1 (Case 1320-02) – Page 1**



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	STANDARD: NON-JEDEC	
	SOT1674-1	29 FEB 2016

Figure 15. **SOT1674-1 (Case 1320-02) – page 2**

NOTES:

1. DIMENSIONS ARE IN INCHES.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994.
3. DIMENSION 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.

PIN 1: GND
PIN 2: +Vout
PIN 3: Vs
PIN 4: –Vout

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	STANDARD: NON–JEDEC	
	SOT1674–1	29 FEB 2016

Revision history

Table 9. **Document revision history**

Date	Version	Changes
07-Jul-2026	1	Initial release from ST, rebranded NXP document