

MPX2102A

CASE 344

UNIBODY PACKAGES



MPX2102AP/GP CASE 344B



MPX2102DP CASE 344C



MPX2102GVP CASE 344D

MPAK



MPX2102ASX CASE 344F

SMALL OUTLINE PACKAGE

MPXV2102GP CASE 1369

MPXM2102A/ATI MPXM2102D/DT1 CASE 1320



MPXM2102AS/AST1 MPXM2102GS/AS CASE 1320A

Operating Characteristics

Table 1. Operating Characteristics	s (V _S = 10 V _{DC}	, T _A = 25°C unless otherwise	e noted, P1 > P2)
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Characteristic	Symbol	Min	Тур	Max	Units
Pressure Range ⁽¹⁾ Absolute Pressure Range MPX2102A Differential Pressure Range MPX2102D	P _{OP} P _{OP}	20 0	_	100 100	kPa kPa
Supply Voltage ⁽²⁾	V _S	—	10	16	V _{DC}
Supply Current	Ι _Ο	—	6.0	—	mAdc
Full Scale Span ⁽³⁾	V _{FSS}	38.5	40	41.5	mV
Offset ⁽⁴⁾ MPX2102D Series MPX2102A Series MPXM2102D/G Series MPXM2102A Series	V _{OFF} V _{OFF}	-1.0 -2.0 -1.0 -2.0	 	1.0 2.0 1.0 2.0	mV mV
Sensitivity	$\Delta V / \Delta P$	—	0.4	—	mV/kPa
Linearity ⁽⁵⁾ MPX2102D Series MPX2102A Series MPXM2102D/G Series MPXM2102A Series	 	-0.6 -1.0 -0.6 -1.0	_ _ _ _	0.4 1.0 0.4 1.0	%V _{FSS} %V _{FSS}
Pressure Hysteresis ⁽⁵⁾ (0 to 100 kPa)	_	—	±0.1	—	%V _{FSS}
Temperature Hysteresis ⁽⁵⁾ (-40°C to +125°C)	_	—	±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	W
Output Impedance	Z _{OUT}	1400	_	3000	W
Response Time ⁽⁶⁾ (10% to 90%)	t _R	—	1.0		ms
Warm-Up Time	_		20		ms
Offset Stability ⁽⁷⁾	—	—	±0.5	—	%V _{FSS}

1. 1.0 kPa (kiloPascal) 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 with 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.

6. Response Time is defined as the time from 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. Offset stability is the product's output deviation when subjected to 1000 hours of Pulsed Pressure, Temperature Cycling with Bias Test.



Maximum Ratings

Table 2. Maximum Ratings⁽¹⁾

Rating	Symbol	Value	Unit
Maximum Pressure (P1 > P2)	P _{MAX}	400	kPa
Storage Temperature	T _{STG}	-40 to +125	°C
Operating Temperature	T _A	-40 to +125	°C

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

Voltage Output vs. Applied Differential

The differential voltage output of the sensor is directly proportional to the differential pressure applied.

The absolute sensor has a built-in reference vacuum. The output voltage will decrease as vacuum, relative to ambient, is drawn on the pressure (P1) side.

The output voltage of the differential or gauge sensor increases with increasing pressure applied to the pressure

(P1) side relative to the vacuum (P2) side. Similarly, output voltage increases as increasing vacuum is applied to the vacuum (P2) side relative to the pressure (P1) side.

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

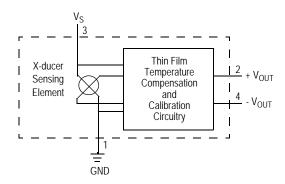


Figure 1. Temperature Compensated Pressure Sensor Schematic



On-Chip Temperature Compensation and Calibration

Figure 2 shows the output characteristics of the MPX2102 series at 25°C. The output is directly proportional to the differential pressure and is essentially a straight line.

The effects of temperature on Full Scale Span and Offset are very small and are shown under Operating Characteristics.

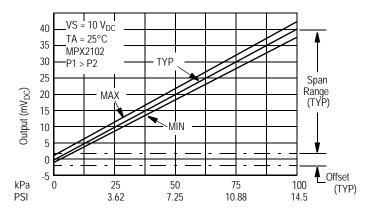


Figure 2. Output vs. Pressure Differential

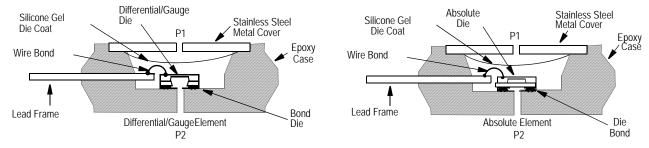




Figure 3 illustrates the absolute sensing configuration (right) and the differential or gauge configuration in the basic chip carrier (Case 344). A silicone gel isolates the die surface and wire bonds from the environment, while allowing the pressure signal to be transmitted to the silicon diaphragm.

The MPX2102 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.

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. There are two basic methods for calculating nonlinearity: (1) end point straight line fit (see Figure 4) or (2) a 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. Freescale's specified pressure sensor linearities are based on the end point straight line method measured at the midrange pressure.

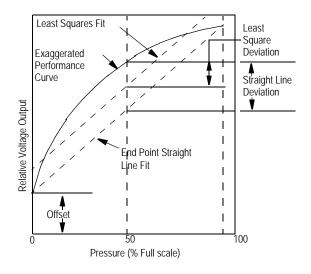


Figure 4. Linearity Specification Comparison



PRESSURE (P1)/VACUUM (P2) SIDE IDENTIFICATION TABLE

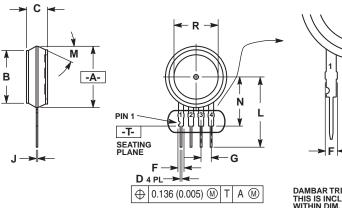
Freescale designates the two sides of the pressure sensor as the Pressure (P1) side and the Vacuum (P2) side. The Pressure (P1) side is the side containing the silicone gel which isolates the die. The differential or gauge sensor is designed to operate with positive differential pressure applied, P1 > P2. The absolute sensor is designed for vacuum applied to P1 side.

The Pressure (P1) side may be identified by using Table 3.

Table 3. Pressure (P1) Side Delineation

Part Number	Case Type	Pressure (P1) Side Identifier
MPX2102A	344	Stainless Steel Cap
MPX2102DP	344C	Side with Part Marking
MPX2102AP, MPX2102GP	344B	Side with Port Attached
MPX2102GVP	344D	Stainless Steel Cap
MPX2102ASX	344F	Side with Port Marking
MPXV2102GP	1369	Side with Port Attached
MPXM2102A, MPX2102ATI, MPXM2102D, MPXM2102DT1	1320	Stainless Steel Cap
MPXM2102AS, MPXM2102GS, MPXM2102ASTI, MPXM2102GSTI	1320A	Side with Port Attached





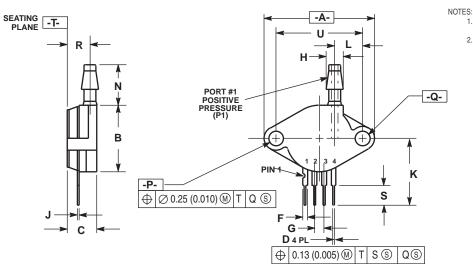
¥ z DAMBAR TRIM ZONE: THIS IS INCLUDED WITHIN DIM. "F" 8 PL

1. DIMENSIONING AND TOLERANCING PER ASME

DIMENSIONING AND TOLENANCING PER ASME Y14.5M, 1994.
 CONTROLLING DIMENSION: INCH.
 DIMENSION -A- IS INCLUSIVE OF THE MOLD STOP RING. MOLD STOP RING NOT TO EXCEED 16.00 (0.630).

	INCHES		MILLIMETER	
DIM	MIN	MAX	MIN	MAX
Α	0.595	0.630	15.11	16.00
В	0.514	0.534	13.06	13.56
С	0.200	0.220	5.08	5.59
D	0.016	0.020	0.41	0.51
F	0.048	0.064	1.22	1.63
G	0.100) BSC	2.54 BSC	
ſ	0.014	0.016	0.36	0.40
L	0.695	0.725	17.65	18.42
Μ	30°	NOM	30° NOM	
Ν	0.475	0.495	12.07	12.57
R	0.430	0.450	10.92	11.43
Υ	0.048	0.052	1.22	1.32
Ζ	0.106	0.118	2.68	3.00

CASE 344-15 ISSUE AA UNIBODY PACKAGE



DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

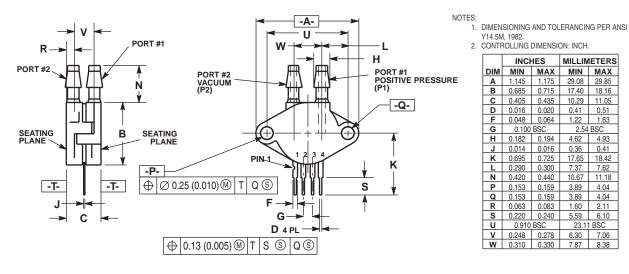
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	INC	INCHES		IETERS
DIM	MIN	MAX	MIN MAX	
Α	1.145	1.175	29.08	29.85
В	0.685	0.715	17.40	18.16
С	0.305	0.325	7.75	8.26
D	0.016	0.020	0.41	0.51
F	0.048	0.064	1.22	1.63
G	0.10) BSC	2.54	BSC
Н	0.182	0.194	4.62	4.93
J	0.014	0.016	0.36	0.41
κ	0.695	0.725	17.65	18.42
L	0.290	0.300	7.37	7.62
Ν	0.420	0.440	10.67	11.18
Р	0.153	0.159	3.89	4.04
Q	0.153	0.159	3.89	4.04
R	0.230	0.250	5.84	6.35
S	0.220	0.240	5.59	6.10
U	0.910) BSC	23.11	I BSC

CASE 344B-01 ISSUE B UNIBODY PACKAGE

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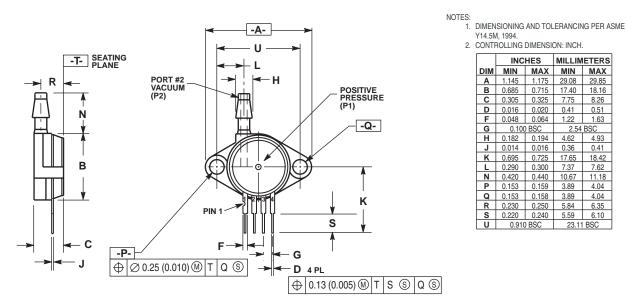




	INC	IES	MILLIMETER	
DIM	MIN	MAX	MIN	MAX
Α	1.145	1.175	29.08	29.85
В	0.685	0.715	17.40	18.16
С	0.405	0.435	10.29	11.05
D	0.016	0.020	0.41	0.51
F	0.048	0.064	1.22	1.63
G	0.100 BSC		2.54 BSC	
н	0.182	0.194	4.62	4.93
J	0.014	0.016	0.36	0.41
κ	0.695	0.725	17.65	18.42
L	0.290	0.300	7.37	7.62
Ν	0.420	0.440	10.67	11.18
Р	0.153	0.159	3.89	4.04
Q	0.153	0.159	3.89	4.04
R	0.063	0.083	1.60	2.11
S	0.220	0.240	5.59	6.10
U	0.910	BSC	23.1	1 BSC
٧	0.248	0.278	6.30	7.06
w	0.310	0.330	7.87	8.38

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CASE 344C-01 **ISSUE B UNIBODY PACKAGE**



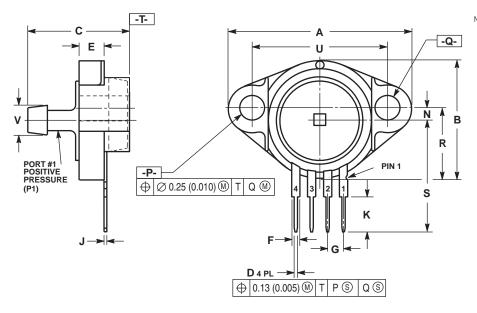
2. CONTROLLING DIMENSION: INCH. MILLIMETERS INCHES DIM MIN MAX MIN MAX A 1.145 1.175 29.08 29.85 B 0.685 0.715 17.40 18.16 C 0.305 0.325 7.75 8.26 D 0.016 0.020 0.41 0.51 F 0.048 0.064 1.22 1.63 G 0.100 BSC 2.54 BSC

Y14.5M, 1994.

0.182	0.194	4.00	4.00
	0.134	4.62	4.93
0.014	0.016	0.36	0.41
0.695	0.725	17.65	18.42
0.290	0.300	7.37	7.62
0.420	0.440	10.67	11.18
0.153	0.159	3.89	4.04
0.153	0.158	3.89	4.04
0.230	0.250	5.84	6.35
0.220	0.240	5.59	6.10
0.910 BSC		23.11	BSC
	0.695 0.290 0.420 0.153 0.153 0.230 0.220	0.695 0.725 0.290 0.300 0.420 0.440 0.153 0.159 0.153 0.158 0.230 0.250 0.220 0.240	0.695 0.725 17.65 0.290 0.300 7.37 0.420 0.440 10.67 0.153 0.159 3.89 0.153 0.158 3.89 0.230 0.220 5.84 0.220 0.240 5.59

CASE 344D-01 **ISSUE B UNIBODY PACKAGE**





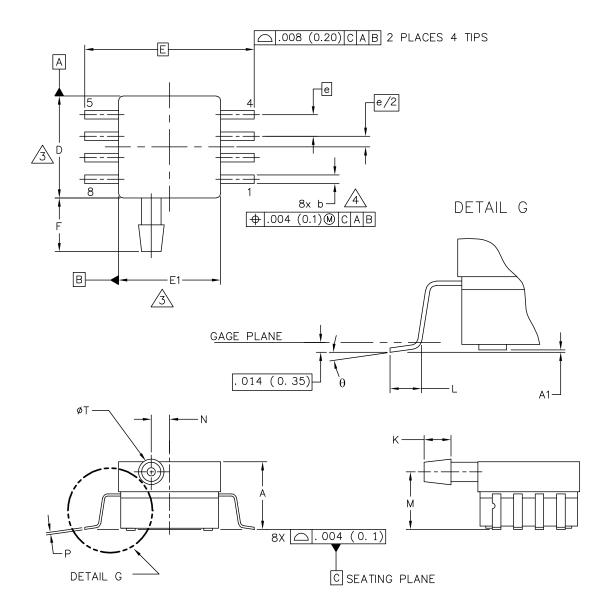
NOTES:	
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DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 CONTROLLING DIMENSION: INCH.

	INC	HES	MILLIMETERS	
DIM	MIN	MAX		
Α	1.080	1.120	27.43	28.45
В	0.740	0.760	18.80	19.30
С	0.630	0.650	16.00	16.51
D	0.016	0.020	0.41	0.51
Е	0.160	0.180	4.06	4.57
F	0.048	0.064	1.22	1.63
G	0.100	0.100 BSC		BSC
J	0.014	0.016	0.36	0.41
κ	0.220	0.240	5.59	6.10
Ν	0.070	0.080	1.78	2.03
Р	0.150	0.160	3.81	4.06
Q	0.150	0.160	3.81	4.06
R	0.440	0.460	11.18	11.68
S	0.695	0.725	17.65	18.42
U	0.840	0.860	21.34	21.84
٧	0.182	0.194	4.62	4.92

CASE 344F-01 **ISSUE B UNIBODY PACKAGE**





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8 LD SOP, SIDE PO	ORT CASE NUMBER	R: 1369–01	24 MAY 2005
	STANDARD: N	ON-JEDEC	

CASE 1369-01 ISSUE B SMALL OUTLINE PACKAGE



NOTES:

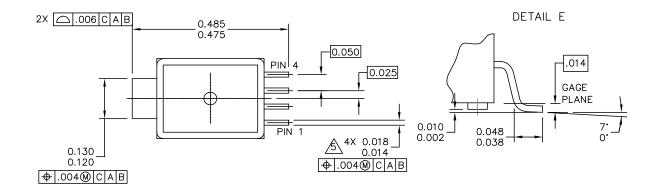
- 1. CONTROLLING DIMENSION: INCH
- 2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
- A DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PPROTRUSIONS. MOLD FLASH AND PROTRUSIONS SHALL NOT EXCEED .006 (0.152) PER SIDE.
- A DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .008 (0.203) MAXIMUM.

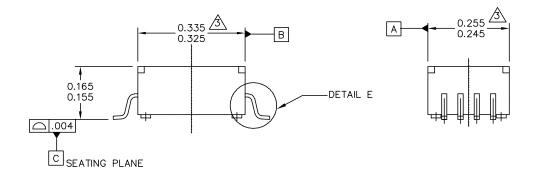
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A1	. 002	. 010	0. 05	0. 25	-				
b	. 038	. 042	0.96	1.07	-				
D	. 465	. 485	11.81	12.32	-				
E	. 717	BSC	18	.21 BSC	-				
E1	. 465	. 485	11.81	12.32	-				
e	. 100	BSC	2.	54 BSC	-				
F	. 245	. 255	6. 22	6.47	-				
к	. 120	. 130	3. 05	3. 30	-				
L	. 061	. 071	1. 55	1.80	-				
м	. 270	. 290	6. 86	7.36	-				
N	. 080	. 090	2. 03	2. 28	-				
Р	. 009	. 011	0. 23	0. 28	-				
Т	. 115	. 125	2. 92	3. 17	-				
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				STAI	NDARD: NC	N-JEDEC			

PAGE 2 OF 2

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5 LD M-PAC		CASE NUMBER	2: 1320-02	22 JUL 2005
		STANDARD: NE	IN-JEDEC	

CASE 1320-02 ISSUE B MPAK

MPX2102

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NOTES:

1. DIMENSIONS ARE IN INCHES.

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

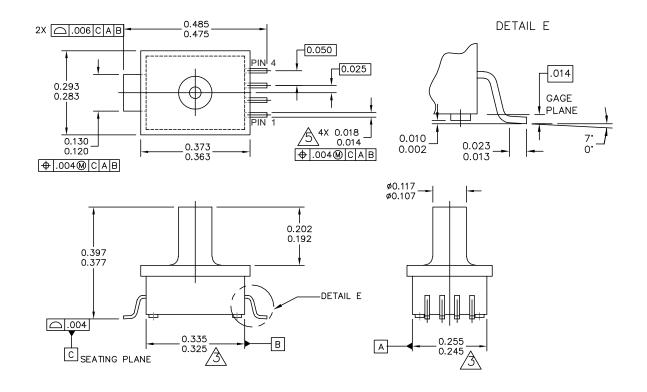
A DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION.

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

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	STANDAR	D: NON-JEDEC	

CASE 1320-02 **ISSUE B MPAK**





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	STANDARD: NO	N-JEDEC		

CASE 1320A-02 **ISSUE A** MPAK

MPX2102

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1. DIMENSIONS ARE IN INCHES.

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

A 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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5 LD M-PAC, POR	ED C,	ASE NUMBER	: 1320A-02	22 JUL 2005
	S	TANDARD: NO	N-JEDEC	

CASE 1320A-02 ISSUE A MPAK



Pressure

REVISI	ON HISTORY	
Revis numb		Description of changes
9	01/2012	In Table 1. Operating Characteristics, in the Characteristic column under Pressure Range, added rows for Absolute Pressure Range MPX2102A and Differential Pressure Range MPX2102D devices



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