Freescale Semiconductor

MPX2200
Rev 13, 10/2008

200 kPa On-Chip Temperature Compensated Silicon Pressure Sensors

MPX2200 Series

0 to 200 kPa (0 to 29 psi)
40 mV Full Scale Span
(Typical)

The MPX2200 series devices are 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. They are designed for use in applications such as pump/motor controllers, robotics, level indicators, medical diagnostics, pressure switching, barometers, altimeters, etc.

Features

- Temperature Compensated Over 0°C to +85°C
- ±0.25% Linearity (MPX2200D)
- Easy-to-Use Chip Carrier Package Options
- Absolute, Differential and Gauge Options

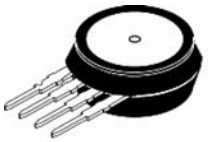
Application Examples

- Pump/Motor Control
- Robotics
- Level Detectors
- Medical Diagnostics
- Pressure Switching
- Barometers
- Altimeters

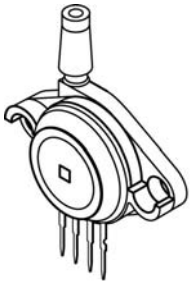
ORDERING INFORMATION

Device Name	Package Options	Case No.	# of Ports			Pressure Type			Device Marking
			None	Single	Dual	Gauge	Differential	Absolute	
Unibody Package (MPX2200 Series)									
MPX2200A	Tray	344	•					•	MPX2200A
MPX2200D	Tray	344	•				•		MPX2200D
MPX2200DP	Tray	344C			•		•		MPX2200DP
MPX2200AP	Tray	344B		•				•	MPX2200AP
MPX2200GP	Tray	344B		•		•			MPX2200GP

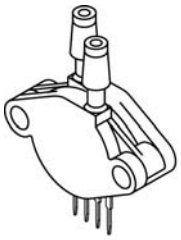
UNIBODY PACKAGES



MPX2200A/D
CASE 344-15



MPX2200AP/GP
CASE 344B-01



MPX2200DP
CASE 344C-01

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Operating Characteristics

Table 1. Operating Characteristics (V_S = 10 V_{DC}, T_A = 25°C unless otherwise noted, P1 > P2)

Characteristic		Symbol	Min	Typ	Max	Units
Differential Pressure Range[1]		P_{OP}	0	—	200	kPa
Supply Voltage[2]		V_S	—	10	16	V_{DC}
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		$\Delta V/\Delta P$	—	0.2	—	mV/kPa
Linearity	MPX2200D Series MPX2200A Series	—	-0.25 -1.0	— —	0.25 1.0	$\%V_{FSS}$
Pressure Hysteresis(0 to 200 kPa)		—	—	±0.1	—	$\%V_{FSS}$
Temperature Hysteresis(- 40°C to +125°C)		—	—	±0.5	—	$\%V_{FSS}$
Temperature Coefficient of Full Scale Span		TCV_{FSS}	-1.0	—	1.0	$\%V_{FSS}$
Temperature Coefficient of Offset		TCV_{OFF}	-1.0	—	1.0	mV
Input Impedance		Z_{IN}	1300	—	2500	Ω
Output Impedance		Z_{OUT}	1400	—	3000	Ω
Response Time[5] (10% to 90%)		t_R	—	1.0	—	ms
Warm-Up Time[6]		—	—	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 rated pressure.
4. Offset (V_{OFF}) is defined as the output voltage at the minimum rated pressure.
5. 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.
6. Warm-up Time is defined as the time required for the product to meet the specified output voltage after the pressure is stabilized.
7. Offset stability is the product's output deviation when subjected to 1000 hours of Pulsed Pressure, Temperature Cycling with Bias Test.

INA106 Precision Gain = 10 Differential Amplifier

1 Features

- Gain of 10 difference amplifier configuration
- High common-mode rejection (CMRR): 86dB (minimum)
- Low gain error: 0.025% (maximum)
- Low gain drift: 4ppm/°C (typical)
- Low nonlinearity: 0.001% (maximum)
- Bandwidth: 0.5MHz (typical)
- Low offset voltage: 200µV (maximum)
- Low offset voltage drift: 0.2µV/°C (typical)

2 Applications

- Battery cell formation & test equipment
- Sensor tag & data logger
- Servo drive position feedback
- Level transmitter
- String inverter

3 Description

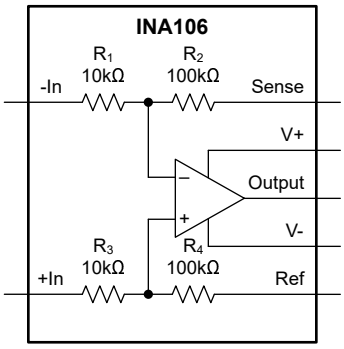
The INA106 is a monolithic gain = 10 differential amplifier consisting of a precision operational amplifier (op amp) and on-chip metal film resistors. The resistors are laser trimmed for accurate gain and high common-mode rejection. Excellent tracking of resistors (TCR) maintains gain accuracy and common-mode rejection over temperature.

The differential amplifier is the foundation of many commonly used circuits. The INA106 provides this precision circuit function without using an expensive resistor network. The INA106 is available in 8-pin plastic DIP and SOIC surface-mount packages.

Package Information

PART NUMBER	PACKAGE(1)	PACKAGE SIZE(2)
INA106	P (PDIP, 8)	9.81mm × 9.43mm
	D (SOIC, 8)	4.9mm × 6mm

(1) For all available packages, see Section 10.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.



Precision Gain = 10 Differential Amplifier

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5.4 Electrical Characteristics

at T_A = 25°C, V_S = ±15V, R_L = 10kΩ, V_{REF} = 0V, and G = 10 (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
INPUT							
V_{OS}	Offset voltage	RTI(1) (2)			50	200	µV
	Offset voltage drift	T_A = –40°C to +85°C, RTI(1) (2)			0.2		µV/°C
PSRR	Power-supply rejection ratio	RTI(1) (2), V_S = ±6V to ±18V			1	10	µV/V
	Long-term stability				10		µV/mo
Z_{IN-DM}	Differential impedance (3)				10		kΩ
Z_{IN-CM}	Common-mode impedance(3)				110		kΩ
V_{CM}	Operating common-mode input voltage(4)			–11		11	V
V_{DM}	Operating differential-mode input voltage(4)			–1		1	V
CMRR	Common-mode rejection ratio(5)	T_A = –40°C to +125°C		86	100		dB
NOISE VOLTAGE							
e_N	Voltage noise	RTI(1) (6)	f_O = 10kHz		30		nV/√Hz
			f_B = 0.01Hz to 10Hz		1.5		$µV_{PP}$
GAIN							
G	Initial gain				10		V/V
GE	Gain error				±0.01	±0.025	%
	Gain drift				–4		ppm/°C
	Gain nonlinearity				0.0002	0.001	% of FSR
OUTPUT							
	Output voltage	I_O = –5mA, 20mA		10	12		V
	Load capacitance stability				1000		pF
I_{SC}	Sourcing	Continuous to V_S / 2			40 to 70		mA
	Sinking				10 to 70		mA
Z_O	Output Impedance				0.01		Ω

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INA114 Precision Instrumentation Amplifier

1 Features

- Low offset voltage: 50µV maximum for high gains
- Low drift: 0.3µV/°C maximum for high gains
- Low input bias current: 2nA maximum
- High common-mode rejection: 115dB minimum
- Input over-voltage protection: ±40V
- Wide supply range: ±2.25V to ±18V
- Packages: PDIP-8 and SOIC-16

2 Applications

- Surgical equipment
- Actuator
- Multifunction relay
- Train control and management
- Trackside signaling and control

3 Description

The INA114 is a low-cost, general-purpose instrumentation amplifier offering excellent accuracy. The versatile three-op-amp design and small size make this device an excellent choice for a wide range of applications.

A single external resistor sets any gain from 1 to 10,000. Internal input protection withstands up to ±40V without damage.

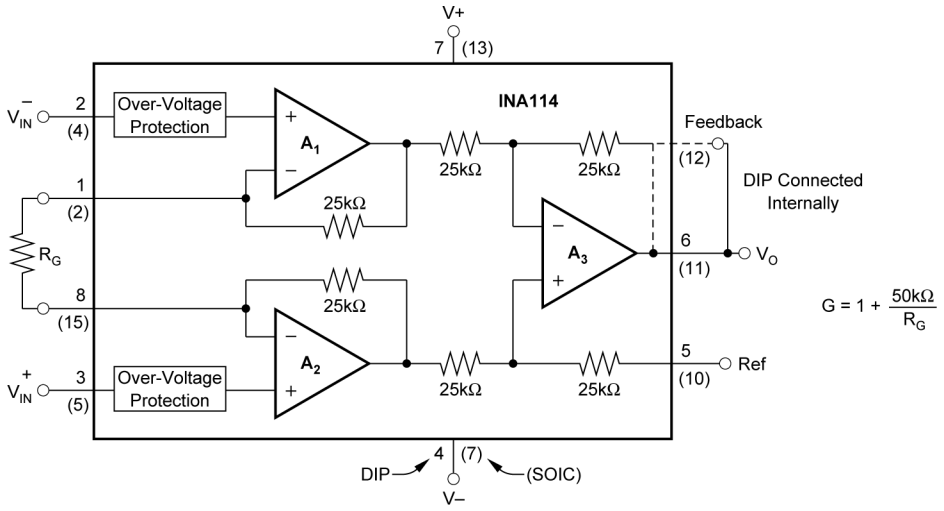
The INA114 is laser trimmed for very low offset voltage (50µV), low drift (0.3µV/°C), and high common-mode rejection (115dB at G = 1000). The device operates with power supplies as low as ±2.25V, allowing use in battery-operated and single 5V supply systems.

The INA114 is available in 8-pin PDIP and 16-pin SOIC surface-mount packages. Both are specified for a temperature range of −40°C to +85°C.

Package Information

PART NUMBER	PACKAGE(1)	PACKAGE SIZE(2)
INA114	P (PDIP, 8)	9.81mm × 9.43mm
	DW (SOIC, 16)	10.3mm × 10.3mm

(1) For more information, see Section 10.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.



Schematic

5.5 Electrical Characteristics (continued)

at T_A = 25°C, V_S = ±15V, R_L = 2kΩ, V_{REF} = 0V, and G = 1 (unless otherwise noted)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
GAIN								
G	Gain equation					1 + (50kΩ / R_G)		V/V
	Range of gain				1		10000	V/V
GE	Gain error	V_O = ±10V, G = 1				±0.01	±0.05	%
		V_O = ±10V	G = 10	INA114BP, BU		±0.02	±0.4	
				INA114AP, AU		±0.02	±0.5	
			G = 100	INA114BP, BU		±0.05	±0.5	
				INA114AP, AU		±0.05	±0.7	
			G = 1000	INA114BP, BU		±0.5	±1	
				INA114AP, AU		±0.5	±2	
	Gain drift					±2	±10	ppm/°C
		R_S = 50kΩ(1)				±25	±100	
	Gain nonlinearity	V_O = –10V to +10V	G = 1	INA114BP, BU		±0.0001	±0.001	% of FSR
				INA114AP, AU		±0.0001	±0.002	
			G = 10, 100	INA114BP, BU		±0.0005	±0.002	
				INA114AP, AU		±0.0005	±0.004	
			G = 1000	INA114BP, BU		±0.002	±0.01	
				INA114AP, AU		±0.002	±0.02	
OUTPUT								
	Output voltage	I_O = 5mA, T_A = –40°C to 85°C			(V–) +1.5		(V+) –1.5	V
			V_S = ±11.4V		(V–) + 1.4		(V+) – 1.4	
			V_S = ±2.25V		(V–) +1		(V+) – 1	
	Load capacitance stability					1000		pF
I_{SC}	Short-circuit current	Continuous to V_S / 2				+20 / –15		mA
FREQUENCY RESPONSE								
BW	Bandwidth, –3dB	G = 1				1		MHz
		G = 10				100		kHz
		G = 100				10		
		G = 1000				1		
SR	Slew rate	G = 10, V_O = ±10V			0.3	0.6		V/µs
t_S	Settling time	0.01%, V_{STEP} = 10V	G = 1			18		µs
			G = 10			20		
			G = 100			120		
			G = 1000			1100		
	Overload recovery	50% overdrive				20		µs
POWER SUPPLY								
I_Q	Quiescent current	V_S = ±2.25V to ±18V, V_{IN} = 0V				±2.2	±3	mA

(1) Temperature coefficient of the "50kΩ" term in the gain equation.

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ADC0808/ADC0809 8-Bit µP Compatible A/D Converters with 8-Channel Multiplexer

Check for Samples: ADC0808-N, ADC0809-N

FEATURES

- **Easy Interface to All Microprocessors**
- **Operates Ratiometrically or with 5 V_{DC} or Analog Span Adjusted Voltage Reference**
- **No Zero or Full-Scale Adjust Required**
- **8-Channel Multiplexer with Address Logic**
- **0V to V_{CC} Input Range**
- **Outputs meet TTL Voltage Level Specifications**
- **ADC0808 Equivalent to MM74C949**
- **ADC0809 Equivalent to MM74C949-1**

KEY SPECIFICATIONS

- **Resolution: 8 Bits**
- **Total Unadjusted Error: ±½ LSB and ±1 LSB**
- **Single Supply: 5 VDC**
- **Low Power: 15 mW**
- **Conversion Time: 100 µs**

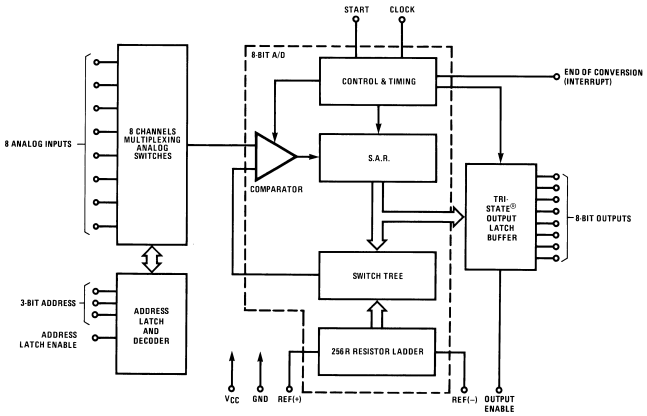
DESCRIPTION

The ADC0808, ADC0809 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique. The converter features a high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register. The 8-channel multiplexer can directly access any of 8-single-ended analog signals.

The device eliminates the need for external zero and full-scale adjustments. Easy interfacing to microprocessors is provided by the latched and decoded multiplexer address inputs and latched TTL TRI-STATE outputs.

The design of the ADC0808, ADC0809 has been optimized by incorporating the most desirable aspects of several A/D conversion techniques. The ADC0808, ADC0809 offers high speed, high accuracy, minimal temperature dependence, excellent long-term accuracy and repeatability, and consumes minimal power. These features make this device ideally suited to applications from process and machine control to consumer and automotive applications. For 16-channel multiplexer with common output (sample/hold port) see ADC0816 data sheet. (See AN-247 (Literature Number SNOA595) for more information.)

Block Diagram



Connection Diagrams

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