Single Supply Bridge Transducer Amplifier

AD22055

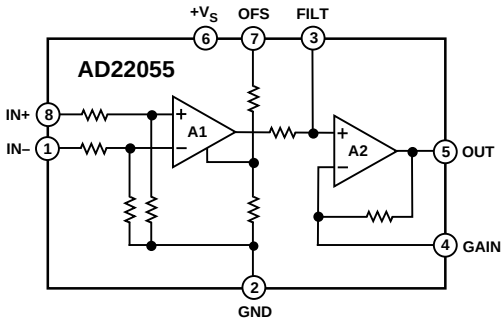
FEATURES

Gain of 400. Alterable from 40 to 1000
Output Span 20 mV to (V_S – 0.25) V
1 Pole Low-Pass Filtering Available
Offset Capability
Differential Input Resistance 230 kΩ
Drives 1 kΩ Load to +4 V Using V_S = +5 V
Supply Voltage: +3 V to +36 V
Transient Spike Protection and RFI Filters Included
Peak Input Voltage (40 ms): 60 V
Reversed Supply Protection: –34 V
Operating Temperature Range: –40°C to +125°C

APPLICATIONS

Interface for Pressure Transducers, Position Indicator, Strain Gages and Other Low Level Signal Sources

FUNCTIONAL BLOCK DIAGRAM



GENERAL DESCRIPTION

The AD22055 accepts a differential signal from a bridge transducer whose common-mode signal can be anywhere between the power supplies.

The extended temperature range allows for local signal conditioning for oil and hydraulic pressure sensors as well as other automotive sensors.

The use of an external gain resistor allows the user to compensate transducer gain error and temperature drift.

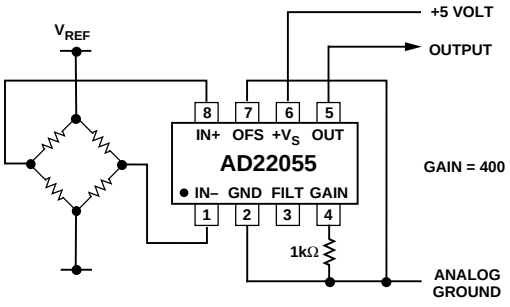


Figure 1. Typical Application Circuit for a Pressure Sensor Interface

REV. 0

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AD22055—SPECIFICATIONS (@ T_A = + 25°C, V_S = +5 V, V_{CM} = 0, unless otherwise noted)

Parameter	Comments	Test Conditions	Min	Typ	Max	Units
INPUTS (PINS 1 AND 8)						
V_{CM}	Common-Mode Range		0		5	V
$CMRR_{LF}$	Common-Mode Rejection Ratio	f ≤ 10 Hz	**–80**	**–90**		dB
$CMRR_{HF}$	Common-Mode Rejection Ratio	f = 10 kHz	**–60**	**–75**		dB
R_{INCM}	Common-Mode Input Resistance	Pin 1 or Pin 8 to Pin 2	**180**	**230**		kΩ
R_{MATCH}	Matching of Input Resistances			±0.5		%
R_{INDIFF}	Differential Input Resistance	Pin 1 to Pin 8	180	230	300	kΩ
PREAMPLIFIER						
G_{CL}	Closed-Loop Gain[1]			40		V/V
V_O	Output Voltage Range (Pin 3)		+0.02		+4.75	V
R_O	Output Resistance[2]		**77.6**	80	**82.4**	kΩ
OUTPUT BUFFER						
G_{CL}	Closed-Loop Gain[1]	R_{LOAD} ≥ 10 kΩ	**9.95**	10	**10.05**	V/V
V_O	Output Voltage Range		**+0.02**		**+4.75**	V
R_O	Output Resistance (Pin 5)	V_O ≥ 0.1 V dc		2.0		Ω
OVERALL SYSTEM						
G_{CL}	Gain[1]	V_O ≥ 0.1 V dc	**398**	400	**402**	V/V
	Gain Drift	–40°C to +125°C		–60		ppm/°C
	Gain Drift	–125°C to +150°C		–500		ppm/°C
V_{OS}	Initial Offset Voltage[3]		–1	0.05	1	mV
	Offset Drift	–40°C to +125°C		1		µV/°C
	Offset Drift	–125°C to +150°C		–10		µV/°C
	Input Resistance	Pin 7 to Pin 2	**2.5**	3.0		kΩ
I_{OSC}	Short-Circuit Output Current		**7**	11	**25**	mA
$BW_{-3\ dB}$	–3 dB Bandwidth	V_O = + 1 V dc	20	30		kHz
SR	Slew Rate			0.2		V/µs
N_{SD}	Noise Spectral Density[3]	f = 100 Hz to 10 kHz		0.2		$\mu V/\sqrt{Hz}$
POWER SUPPLY						
V_S	Operating Range	$T_A = T_{MIN}$ to T_{MAX}	3	**5**	36	V
I_S	Quiescent Supply Current[4]			200	500	µA
TEMPERATURE RANGE						
T_{OP}	Operating Temperature Range		–40		+125	°C

NOTES

[1]A2 gain is trimmed to ±0.5% with a 0.01% 1 kΩ resistor to ground from Pin 4. The overall gain is trimmed to a gain of 400 ±0.5% with the same 1 kΩ resistor. The gain of A1 (the ratio of overall gain to A2 gain) is used to adjust the overall gain and, therefore, is not trimmed explicitly to 40. Note that the actual gain to a particular application can be modified by the use of an external resistor at Pin 4.

[2]The actual output resistance of A1 is only a few ohms, but access to this output, via Pin 3, is always through an 80 kΩ resistor, which is trimmed to ±3%.

[3]Referred to the input (Pins 1 and 8).

[4]With V_{DM} = 0 V. Differential mode signals are referred to as V_{DM}, while V_{CM} refers to common-mode voltages.

All min and max specifications are guaranteed, although only those marked in **boldface** are tested on all production units at final test.

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS[1]

Supply Voltage . . . . . +3 V to +36 V
Peak Input Voltage (40 ms) . . . . . 60 V
Reversed Continuous Supply Voltage . . . . . –34 V
Operating Temperature . . . . . –40°C to +125°C
Storage Temperature . . . . . –65°C to +150°C
Output Short Circuit Duration . . . . . Indefinite
Lead Temperature (Soldering, 60 sec) . . . . . +300°C

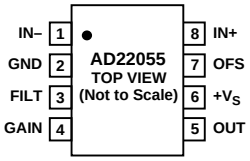
[1]Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only; the functional operation of the device at these or any other conditions above those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option*
AD22055N		Plastic DIP	N-8
AD22055R	–40°C to +125°C	Plastic SOIC	SO-8

*N = Plastic DIP; SO = Small Outline Package.

PIN CONNECTION



PIN DESCRIPTION

8-Pin SOIC Pin	Function
1	IN–
2	Ground
3	Filter
4	Gain
5	Out
6	$+V_S$
7	OFS
8	IN+

PRODUCT DESCRIPTION

The AD22055 is a single supply difference amplifier consisting of a precision balanced attenuator, a very low drift preamplifier and an output buffer amplifier (A1 and A2, respectively, in the functional block diagram). It has been designed so that small differential signals, V_{DM}, can be accurately amplified and filtered in the presence of large common-mode voltages, V_{CM}, without the use of any other active components.

The common-mode range resistors in this network are trimmed to match better than one part in 10,000. The resistive attenuator network is situated at the input to the AD22055 (Pins 1 and 8) allowing the common-mode voltage at Pins 1 and 8 to be two times greater than that which can be tolerated by the actual input of A1. As a result, the input common-mode range extends from ground to the power supply voltage.

Two small filter capacitors (not shown) have been included at the inputs to A1 to minimize the effects of any spurious RF signals present in the signal.

Internal feedback around A1 sets the closed-loop gain of the preamplifier to 40 V/V from the input pins, and the output of A1 is connected to Pin 3 via a 80 kΩ resistor, which is trimmed to ±3% to facilitate the low-pass filtering of the signal. The output buffer A2 has a gain of 10 V/V (using a precise 1 kΩ resistor from Pin 4 to ground) setting the precalibrated, overall gain of the AD22055, to 400 V/V. This gain is easily user-configurable.

Overall gain is programmed using the following equation:

$$Gain = 40\left(1+\frac{9\ k\Omega}{R_{GAIN}}\right)V/V \qquad (1)$$

The dynamic properties of the AD22055 are optimized for interfacing to transducers, particularly those with a Wheatstone Bridge configuration. Its rejection of large, high frequency, common-mode signals makes it superior to that of many alternative approaches. This is due to the very careful design of the input attenuator and the integration of this highly balanced, high impedance system with the preamplifier.

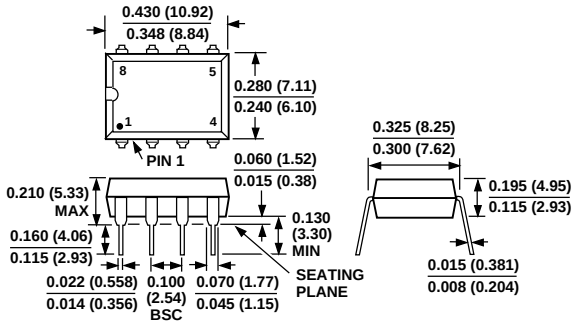
CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the AD22055 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

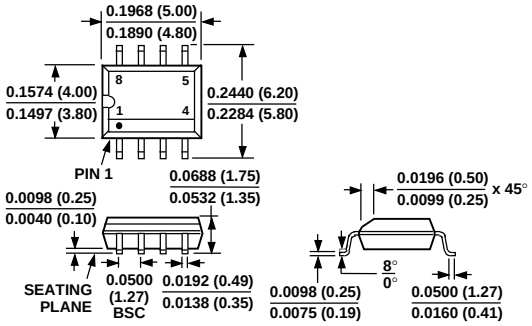
OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).

8-Lead Plastic DIP
(N-8)



8-Lead Plastic SOIC Package
(SO-8)



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