40µA Micropower Instrumentation Amplifier in MSOP

Preliminary Technical Data

AD8236

FEATURES

Low Power
- **40 µA supply current**

Low input currents
- **10 pA input bias current**
- **5 pA input offset current**

High CMRR
- **106 dB CMRR , G = 100**

Space Saving
- **MSOP package**

Versatile
- **Rail-to-rail output**
- **Gain set with single resistor (G = 5 to 200)**

APPLICATIONS

Medical instrumentation
Low side current sense
Portable Electronics

GENERAL DESCRIPTION

The AD8236 is the industry's lowest power instrumentation amplifier. It has rail to rail outputs and can operate on voltages as low as 1.8V. Its 40uA supply current makes it an excellent choice in battery powered applications.

The AD8236 is an excellent choice for signal conditioning. It's low input bias current of 10pA and high CMRR of 106dB (G=100) offer tremendous value for its size and low power. It has a wider common-mode voltage range than typical three op amp in-amps, making this a great solution for applications that operate on a single 1.8V or 3V supply.

It is available in an 8 lead MSOP package and is specified over the industrial temperature range of -40° to 125°C.

BLOCK DIAGRAM

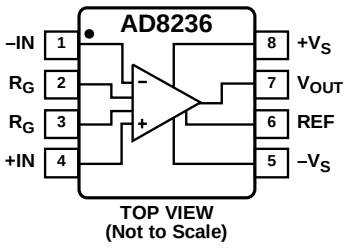

Figure 1.

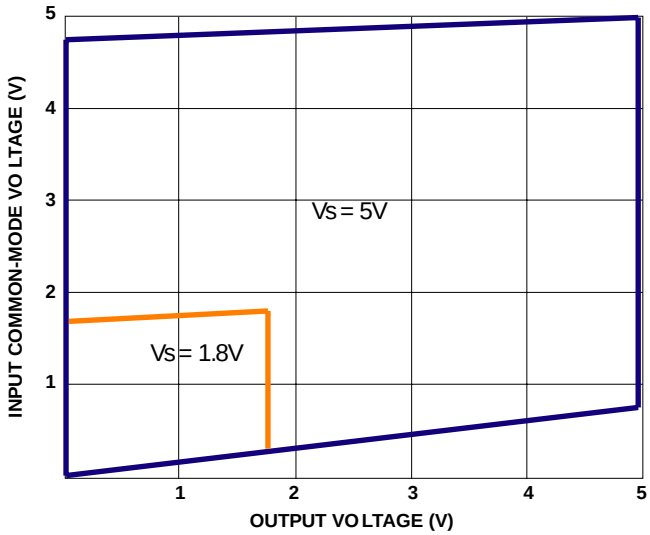

Figure 2. Wide Common Mode Voltage Range vs. Output Voltage, REF = mid-supply

Rev. PrA

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SPECIFICATIONS

V_S + = 5 V, V_S– = 0 V, V_{REF} = 2.5 V, T_A = +25°C, G = 5, R_L = 100 kΩ, unless otherwise noted.

Table 1.

		A Grade			
Parameter	**Test Conditions**	**Min**	**Typ**	**Max**	**Unit**
COMMON-MODE REJECTION RATIO (CMRR)					
CMRR DC with 1 kΩ Source Imbalance					
G = 5			80		dB
G = 10			86		dB
G = 100			106		dB
G = 200			120		dB
NOISE					
Voltage Noise, 1 kHz					
Spectral Density Noise. RTI	G=5		76		nV√Hz
					nV√Hz
RTI, 0.1 Hz to 10 Hz					
G = 5			5		µV p-p
G = 200			TBD		µV p-p
Current Noise			15		fA/√Hz
VOLTAGE OFFSET					
Input Offset, V_{OSI}			5		mV
Average TC			10		µV/°C
Output Offset, V_{OSO}			1		µV
Average TC			TBD		µV/°C
Offset RTI vs. Supply (PSR)					
G = 5		100			dB
G = 10		110			dB
G = 100		110			dB
G = 200		110			dB
INPUT CURRENT					
Input Bias Current				10	pA
Over Temperature	-40C to +85C			100	pA
Over Temperature	-40C to +125C			600	pA
Input Offset Current				5	pA
Over Temperature	-40C to +85C			50	pA
Over Temperature	-40C to +125C			130	pA
DYNAMIC RESPONSE					
Small Signal Bandwidth – 3 dB					
G = 5			30		kHz
G = 10			15		kHz
G = 100			1.5		kHz
G = 200			0.2		kHz
Settling Time 0.01%					
G = 5					µs
G = 10					µs
G = 100					µs
G = 200					µs
Slew Rate					

Parameter	Test Conditions	A Grade Min	A Grade Typ	A Grade Max	Unit
G = 5 to 100			12		mV/µs
GAIN					
Gain Range	G = 5 + 420kΩ/Rg	5		200	V/V
Gain Error					
G = 5					%
G = 10					%
G = 100					%
G =200					%
Nonlinearity					
G = 5					ppm
G = 10					ppm
G = 100					ppm
G = 200					ppm
G = 5	10kΩ				ppm
G = 10	10kΩ				ppm
G = 100	10kΩ				ppm
Gain vs. Temperature					
G = 5	-40°C to +125°C				ppm/°C
G > 10	-40°C to +125°C				ppm/°C
INPUT					
Impedance			220||4		GΩ||pF
Input Voltage Range		0		+Vs	V
Over Temperature					V
OUTPUT					
Output Voltage High, VOH	RL = 100 kΩto GND	4.98	4.99		V
	--40°C to +125°C	4.98			V
	RL = 10 kΩ•to GND	4.9	4.95		
	-40°C to +125°C				V
Output Voltage Low, VOL	RL = 100 kΩ•to VS		2	5	mV
	-40°C to +125°C			5	mV
	RL = 10 kΩ• to VS		10	25	mV
	-40°C to +125°C			30	mV
Short Circuit Limit, Isc			±45		mA
REFERENCE INPUT					
R_{IN}	-IN, +IN = 0V		210		kΩ
I_{IN}			1		µA
Voltage Range		-Vs		+Vs	V
Gain to Output			1		V/V
POWER SUPPLY					
Operating Range		1.8		5.5	V
Quiescent Current			40		µA
Over Temperature					µA
TEMPERATURE RANGE					
For Specified Performance		-40		125	°C

V_S + = 1.8 V, V_S– = 0 V, V_{REF} = 0.9 V, T_A = +25°C, G = 5, R_L = 100 kΩ, unless otherwise noted.

Table 2.

Parameter	Test Conditions	A Grade Min	A Grade Typ	A Grade Max	Unit
COMMON-MODE REJECTION RATIO (CMRR)					
CMRR DC with 1 kΩ Source Imbalance					
G = 5			75		dB
G = 10			80		dB
G = 100			100		dB
G = 200			110		dB
NOISE					
Voltage Noise, 1 kHz					
Spectral Density Noise. RTI	G=5		76		nV√Hz
					nV√Hz
RTI, 0.1 Hz to 10 Hz					
G = 5			5		µV p-p
G = 200			TBD		µV p-p
Current Noise			15		fA/√Hz
VOLTAGE OFFSET					
Input Offset, V_{OSI}			5		mV
Average TC			10		µV/°C
Output Offset, V_{OSO}			1		µV
Average TC			TBD		µV/°C
Offset RTI vs. Supply (PSR)					
G = 5		100			dB
G = 10		110			dB
G = 100		110			dB
G = 200		110			dB
INPUT CURRENT					
Input Bias Current				10	pA
Over Temperature	-40C to +85C			100	pA
Over Temperature	-40C to +125C			600	pA
Input Offset Current				5	pA
Over Temperature	-40C to +85C			50	pA
Over Temperature	-40C to +125C			130	pA
DYNAMIC RESPONSE					
Small Signal Bandwidth – 3 dB					
G = 5			30		kHz
G = 10			15		kHz
G = 100			1.5		kHz
G = 200			0.2		kHz
Settling Time 0.01%					
G = 5					µs
G = 10					µs
G = 100					µs
G = 200					µs
Slew Rate					
G = 5 to 100			12		mV/µs
GAIN					
Gain Range	G = 5 + 420kΩ/Rg	5		200	V/V

Parameter	Test Conditions	A Grade Min	Typ	Max	Unit
Gain Error					
G = 5					%
G = 10					%
G = 100					%
G =200					%
Nonlinearity					
G = 5					ppm
G = 10					ppm
G = 100					ppm
G = 200					ppm
G = 5	10kΩ				ppm
G = 10	10kΩ				ppm
G = 100	10kΩ				ppm
Gain vs. Temperature					
G = 5	-40°C to +125°C				ppm/°C
G > 10	-40°C to +125°C				ppm/°C
INPUT					
Impedance			220||4		GΩ||pF
Input Voltage Range		0		+Vs	V
Over Temperature					V
OUTPUT					
Output Voltage High, VOH	RL = 100 kΩ•to GND	1.78	1.79		V
	--40°C to +125°C	1.78			V
	RL = 10 kΩ•to GND	1.65	1.75		
	-40°C to +125°C	1.65			V
Output Voltage Low, VOL	RL = 100 kΩ•to VS		2	5	mV
	-40°C to +125°C				mV
	RL = 10 kΩ• to VS		12	25	mV
	-40°C to +125°C			25	mV
Short Circuit Limit, Isc			±4.5		mA
REFERENCE INPUT					
R_{IN}	-IN, +IN = 0V		210		kΩ
I_{IN}			1		µA
Voltage Range		-Vs		+Vs	V
Gain to Output			1		V/V
POWER SUPPLY					
Operating Range		1.8		5.5	V
Quiescent Current			40		µA
Over Temperature					µA
TEMPERATURE RANGE					
For Specified Performance		-40		125	°C

ESD 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 this product 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.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

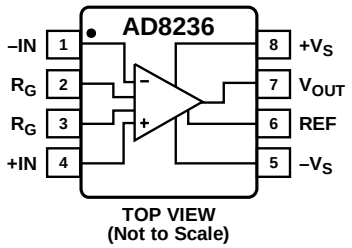

Figure 2. Pin Configuration (Top View)

Table 3. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	–IN	Negative Input Terminal (True Differential Input)
2, 3	R_G	Gain Setting Terminals (Place Resistor Across the R_G Pins)
4	+IN	Positive Input Terminal (True Differential Input)
5	$-V_S$	Negative Power Supply Terminal
6	REF	Reference Voltage Terminal (Drive This Terminal with a Low Impedance Voltage Source to Level-Shift the Output)
7	V_{OUT}	Output Terminal
8	$+V_S$	Positive Power Supply Terminal

OUTLINE DIMENSIONS

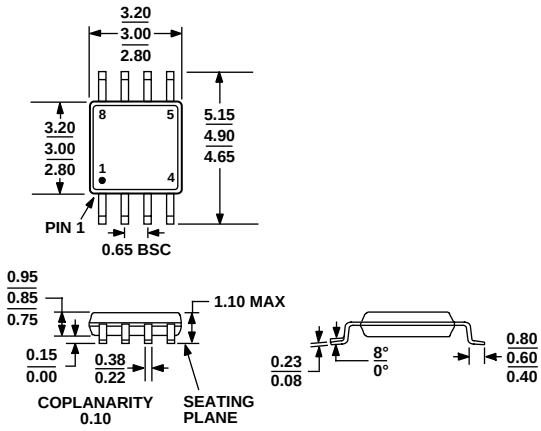

Figure 3. 8-Lead Mini Small Outline Package [MSOP]
(RM-8)
Dimensions shown in millimeters

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option	Branding
AD8236ARMZ	–40°C to +85°C	8-Lead MSOP	RM-8	

PR08000-0-12/08(PrA)