ANALOG DEVICES

JFET Input Instrumentation Amplifier with Rail-to-Rail Output in MSOP Package

Data Sheet **AD8220**

FEATURES

- Low input currents
  - 10 pA maximum input bias current (B grade)
  - 0.6 pA maximum input offset current (B grade)
- High CMRR
  - 100 dB CMRR (minimum), G = 10 (B grade)
  - 80 dB CMRR (minimum) to 5 kHz, G = 1 (B grade)
- Excellent ac specifications and low power
  - 1.5 MHz bandwidth (G = 1)
  - 14 nV/√Hz input noise (1 kHz)
  - Slew rate: 2 V/µs
  - 750 µA quiescent supply current (maximum)
- Versatile
  - MSOP package
  - Rail-to-rail output
  - Input voltage range to below negative supply rail
  - 4 kV ESD protection
  - 4.5 V to 36 V single supply
  - ±2.25 V to ±18 V dual supply
  - Gain set with single resistor (G = 1 to 1000)
- Qualified for automotive applications

APPLICATIONS

Medical instrumentation
Precision data acquisition
Transducer interfaces

PIN CONFIGURATION

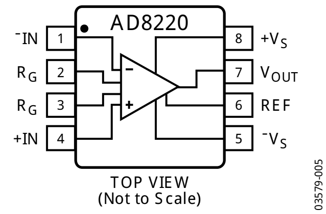

Figure 1.

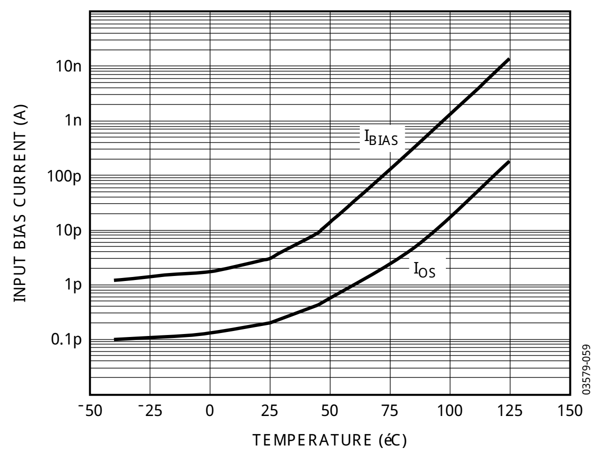

Figure 2. Input Bias Current and Offset Current vs. Temperature

GENERAL DESCRIPTION

The AD8220 is the first single-supply, JFET input instrumentation amplifier available in an MSOP package. Designed to meet the needs of high performance, portable instrumentation, the AD8220 has a minimum common-mode rejection ratio (CMRR) of 86 dB at dc and a minimum CMRR of 80 dB at 5 kHz for G = 1. Maximum input bias current is 10 pA and typically remains below 300 pA over the entire industrial temperature range. Despite the JFET inputs, the AD8220 typically has a noise corner of only 10 Hz.

With the proliferation of mixed-signal processing, the number of power supplies required in each system has grown. The AD8220 is designed to alleviate this problem. The AD8220 can operate on a ±18 V dual supply, as well as on a single +5 V supply. Its rail-to-rail output stage maximizes dynamic range on the low voltage supplies common in portable applications. Its ability to run on a single 5 V supply eliminates the need to use higher voltage, dual supplies. The AD8220 draws a maximum of 750 µA of quiescent current, making it ideal for battery powered devices.

Gain is set from 1 to 1000 with a single resistor. Increasing the gain increases the common-mode rejection. Measurements that need higher CMRR when reading small signals benefit when the AD8220 is set for large gains.

A reference pin allows the user to offset the output voltage. This feature is useful when interfacing with analog-to-digital converters.

The AD8220 is available in an MSOP that takes roughly half the board area of an SOIC. Performance for the A and B grade is specified over the industrial temperature range of −40°C to +85°C, and the W grade is specified over the automotive temperature range of −40°C to +125°C.

Rev. C
Document Feedback

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700

Technical Support www.analog.com

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4/2006—Revision 0: Initial Version

SPECIFICATIONS

$V_S+ = 15$ V, $V_S- = -15$ V, $V_{REF} = 0$ V, $T_A = 25°C$, $T_{OPR} = -40°C$ to $+85°C$ for A and B grades. $T_{OPR} = -40°C$ to $+125°C$ for W grade, $G = 1$, $R_L = 2$ kΩ[1], unless otherwise noted.

Table 1.

Parameter	Test Conditions	A Grade			B Grade			W Grade			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
COMMON-MODE REJECTION RATIO (CMRR)	T_A for A, B grades, T_{OPR} for W grade										
CMRR DC to 60 Hz with 1 kΩ Source Imbalance	$V_{CM} = \pm10$ V										
G = 1		78			86			77			dB
G = 10		94			100			92			dB
G = 100		94			100			92			dB
G = 1000		94			100			92			dB
CMRR at 5 kHz	$V_{CM} = \pm10$ V										
G = 1		74			80			72			dB
G = 10		84			90			80			dB
G = 100		84			90			80			dB
G = 1000		84			90			80			dB
NOISE	RTI noise = $\sqrt{(e_{ni}^2 + (e_{no}/G)^2)}$, T_A										
Voltage Noise, 1 kHz											
Input Voltage Noise, e_{ni}	$V_{IN}+$, $V_{IN}- = 0$ V		14			14	17		14		nV/√Hz
Output Voltage Noise, e_{no}	$V_{IN}+$, $V_{IN}- = 0$ V		90			90	100		90		nV/√Hz
RTI, 0.1 Hz to 10 Hz											
G = 1			5			5			5		µV p-p
G = 1000			0.8			0.8			0.8		µV p-p
Current Noise	f = 1 kHz		1			1			1		fA/√Hz
VOLTAGE OFFSET	$V_{OS} = V_{OSI} + V_{OSO}/G$										
Input Offset, V_{OSI}	T_A	−250		+250	−125		+125	−250		+250	µV
Average TC	T_{OPR}	−10		+10	−5		+5	−10		+10	µV/°C
Output Offset, V_{OSO}	T_A	−750		+750	−500		+500	−750		+750	µV
Average TC	T_{OPR}	−10		+10	−5		+5	−10		+10	µV/°C
Offset RTI vs. Supply (PSR)	$V_S = \pm5$ V to ±15 V, T_A for A, B grades, T_{OPR} for W grade										
G = 1		86			86			80			dB
G = 10		96			100			92			dB
G = 100		96			100			92			dB
G = 1000		96			100			92			dB
INPUT CURRENT											
Input Bias Current	T_A			25			10			25	pA
Over Temperature	T_{OPR}		0.3			0.3				100	nA
Input Offset Current	T_A			2			0.6			2	pA
Over Temperature	T_{OPR}		0.005			0.005				10	nA
DYNAMIC RESPONSE											
Small Signal Bandwidth, −3 dB	T_A										
G = 1			1500			1500			1500		kHz
G = 10			800			800			800		kHz
G = 100			120			120			120		kHz
G = 1000			14			14			14		kHz

Parameter	Test Conditions	A Grade Min	A Grade Typ	A Grade Max	B Grade Min	B Grade Typ	B Grade Max	W Grade Min	W Grade Typ	W Grade Max	Unit
Settling Time 0.01%	10 V step, T_A										
G = 1			5			5			5		µs
G = 10			4.3			4.3			4.3		µs
G = 100			8.1			8.1			8.1		µs
G = 1000			58			58			58		µs
Settling Time 0.001%	10 V step, T_A										
G = 1			6			6			6		µs
G = 10			4.6			4.6			4.6		µs
G = 100			9.6			9.6			9.6		µs
G = 1000			74			74			74		µs
Slew Rate											
G = 1 to 100	T_A	2			2			2			V/µs
GAIN	G = 1 + (49.4 kΩ/R_G), T_A for A, B grades, T_{OPR} for W grade										
Gain Range		1		1000	1		1000	1		1000	V/V
Gain Error	V_{OUT} = ±10 V										
G = 1		−0.06		+0.06	−0.04		+0.04	−0.1		+0.1	%
G = 10		−0.3		+0.3	−0.2		+0.2	−0.8		+0.8	%
G = 100		−0.3		+0.3	−0.2		+0.2	−0.8		+0.8	%
G = 1000		−0.3		+0.3	−0.2		+0.2	−0.8		+0.8	%
Gain Nonlinearity	V_{OUT} = −10 V to +10 V, T_A										
G = 1	R_L = 10 kΩ		10	15		10	15		10	15	ppm
G = 10	R_L = 10 kΩ		5	10		5	10		5	10	ppm
G = 100	R_L = 10 kΩ		30	60		30	60		30	60	ppm
G = 1000	R_L = 10 kΩ		400	500		400	500		400	500	ppm
G = 1	R_L = 2 kΩ		10	15		10	15		10	15	ppm
G = 10	R_L = 2 kΩ		10	15		10	15		10	15	ppm
G = 100	R_L = 2 kΩ		50	75		50	75		50	75	ppm
Gain vs. Temperature											
G = 1			3	10		2	5		3	10	ppm/°C
G > 10				−50			−50			−50	ppm/°C
INPUT											
Impedance (Pin to Ground)[2]	T_A		10^4||5			10^4||5			10^4||5		GΩ||pF
Input Operating Voltage Range[3]	V_S = ±2.25 V to ±18 V for dual supplies	$-V_S$ − 0.1		$+V_S$ − 2	$-V_S$ − 0.1		$+V_S$ − 2	$-V_S$ − 0.1		$+V_S$ − 2	V
Over Temperature	T_{OPR}	$-V_S$ − 0.1		$+V_S$ − 2.1	$-V_S$ − 0.1		$+V_S$ − 2.1	$-V_S$ − 0.1		$+V_S$ − 2.2	V
OUTPUT											
Output Swing	R_L = 10 kΩ, T_A	−14.7		+14.7	−14.7		+14.7	−14.7		+14.7	V
Over Temperature	T_{OPR}	−14.6		+14.6	−14.6		+14.6	−14.3		+14.3	V
Short-Circuit Current	T_A		15			15			15		mA
REFERENCE INPUT	T_A										kΩ
R_{IN}			40			40			40		µA
I_{IN}	$V_{IN}+$, $V_{IN}-$ = 0 V			70			70			70	V
Voltage Range		$-V_S$		$+V_S$	$-V_S$		$+V_S$			$+V_S$	V/V
Gain to Output	T_A		1 ± 0.0001			1 ± 0.0001				1 ± 0.0001	V/V

Parameter	Test Conditions	A Grade Min	A Grade Typ	A Grade Max	B Grade Min	B Grade Typ	B Grade Max	W Grade Min	W Grade Typ	W Grade Max	Unit
POWER SUPPLY											
Operating Range		±2.25[4]		±18	±2.25[4]		±18	±2.25[4]		±18	V
Quiescent Current	T_A			750			750			750	µA
Over Temperature	T_{OPR}			850			850			1000	µA
TEMPERATURE RANGE											
For Specified Performance	T_{OPR}	−40		+85	−40		+85	−40		+125	°C

[1] When the output sinks more than 4 mA, use a 47 pF capacitor in parallel with the load to prevent ringing. Otherwise, use a larger load, such as 10 kΩ.
[2] Differential and common-mode input impedance can be calculated from the pin impedance: $Z_{DIFF} = 2(Z_{PIN})$; $Z_{CM} = Z_{PIN}/2$.
[3] The AD8220 can operate up to a diode drop below the negative supply but the bias current increases sharply. The input voltage range reflects the maximum allowable voltage where the input bias current is within the specification.
[4] At this supply voltage, ensure that the input common-mode voltage is within the input voltage range specification.

$V_S+ = 5$ V, $V_S- = 0$ V, $V_{REF} = 2.5$ V, $T_A = 25°C$, $T_{OPR} = −40°C$ to +85°C for A and B grades. $T_{OPR} = −40°C$ to +125°C for W grade, G = 1, $R_L = 2$ kΩ[1], unless otherwise noted.

Table 2.

Parameter	Test Conditions	A Grade Min	A Grade Typ	A Grade Max	B Grade Min	B Grade Typ	B Grade Max	W Grade Min	W Grade Typ	W Grade Max	Unit
COMMON-MODE REJECTION RATIO (CMRR)	T_A for A, B grades, T_{OPR} for W grade										
CMRR DC to 60 Hz with 1 kΩ Source Imbalance	V_{CM} = 0 to 2.5 V										
G = 1		78			86			77			dB
G = 10		94			100			92			dB
G = 100		94			100			92			dB
G = 1000		94			100			92			dB
CMRR at 5 kHz	V_{CM} = 0 to 2.5 V										
G = 1		74			80			72			dB
G = 10		84			90			80			dB
G = 100		84			90			80			dB
G = 1000		84			90			80			dB
NOISE	RTI noise = $\sqrt{(e_{ni}^2 + (e_{no}/G)^2)}$, T_A										
Voltage Noise, 1 kHz	V_S = ±2.5 V										
Input Voltage Noise, e_{ni}	$V_{IN}+$, $V_{IN}-$ = 0 V, V_{REF} = 0 V		14			14	17		14		nV/√Hz
Output Voltage Noise, e_{no}	$V_{IN}+$, $V_{IN}-$ = 0 V, V_{REF} = 0 V		90			90	100		90		nV/√Hz
RTI, 0.1 Hz to 10 Hz											
G = 1			5			5			5		µV p-p
G = 1000			0.8			0.8			0.8		µV p-p
Current Noise	f = 1 kHz		1			1			1		fA/√Hz
VOLTAGE OFFSET	$V_{OS} = V_{OSI} + V_{OSO}/G$										
Input Offset, V_{OSI}	T_A	−300		+300	−200		+200	−300		+300	µV
Average TC	T_{OPR}	−10		+10	−5		+5	−10		10	µV/°C
Output Offset, V_{OSO}	T_A	−800		+800	−600		+600	−800		+800	µV
Average TC	T_{OPR}	−10		+10	−5		+5	−10		+10	µV/°C
Offset RTI vs. Supply (PSR)	T_A for A, B grades, T_{OPR} for W grade										
G = 1		86			86			80			dB
G = 10		96			100			92			dB
G = 100		96			100			92			dB
G = 1000		96			100			92			dB

Parameter	Test Conditions	A Grade Min	A Grade Typ	A Grade Max	B Grade Min	B Grade Typ	B Grade Max	W Grade Min	W Grade Typ	W Grade Max	Unit
INPUT CURRENT											
Input Bias Current	T_A			25			10			25	pA
Over Temperature	T_{OPR}		0.3			0.3				100	nA
Input Offset Current	T_A			2			0.6			2	pA
Over Temperature	T_{OPR}		0.005			0.005				10	nA
DYNAMIC RESPONSE	T_A										
Small Signal Bandwidth, −3 dB											
G = 1			1500			1500			1500		kHz
G = 10			800			800			800		kHz
G = 100			120			120			120		kHz
G = 1000			14			14			14		kHz
Settling Time 0.01%	T_A										
G = 1	3 V step		2.5			2.5			2.5		µs
G = 10	4 V step		2.5			2.5			2.5		µs
G = 100	4 V step		7.5			7.5			7.5		µs
G = 1000	4 V step		30			30			30		µs
Settling Time 0.001%	T_A										
G = 1	3 V step		3.5			3.5			3.5		µs
G = 10	4 V step		3.5			3.5			3.5		µs
G = 100	4 V step		8.5			8.5			8.5		µs
G = 1000	4 V step		37			37			37		µs
Slew Rate											
G = 1 to 100	T_A	2			2			2			V/µs
GAIN	G = 1 + (49.4 kΩ/R_G), T_A for A, B grades, T_{OPR} for W grade										
Gain Range		1		1000	1		1000	1		1000	V/V
Gain Error	V_{OUT} = 0.3 V to 2.9 V for G = 1, V_{OUT} = 0.3 V to 3.8 V for G > 1										
G = 1		−0.06		+0.06	−0.04		+0.04	−0.1		+0.1	%
G = 10		−0.3		+0.3	−0.2		+0.2	−0.8		+0.8	%
G = 100		−0.3		+0.3	−0.2		+0.2	−0.8		+0.8	%
G = 1000		−0.3		+0.3	−0.2		+0.2	−0.8		+0.8	%
Nonlinearity	V_{OUT} = 0.3 V to 2.9 V for G = 1, V_{OUT} = 0.3 V to 3.8 V for G > 1, T_A										
G = 1	R_L = 10 kΩ		35	50		35	50			50	ppm
G = 10	R_L = 10 kΩ		35	50		35	50			50	ppm
G = 100	R_L = 10 kΩ		50	75		50	75			75	ppm
G = 1000	R_L = 10 kΩ		650	750		650	750			750	ppm
G = 1	R_L = 2 kΩ		35	50		35	50			50	ppm
G = 10	R_L = 2 kΩ		35	50		35	50			50	ppm
G = 100	R_L = 2 kΩ		50	75		50	75			75	ppm
Gain vs. Temperature											
G = 1			3	10		2	5		3	10	ppm/°C
G > 10				−50			−50			−50	ppm/°C
INPUT											
Impedance (Pin to Ground)[2]	T_A		10^4||6			10^4||6			10^4||6		GΩ||pF
Input Voltage Range[3]	T_A	−0.1		$+V_S - 2$	−0.1		$+V_S - 2$				V
Over Temperature	T_{OPR}	−0.1		$+V_S - 2.1$	−0.1		$+V_S - 2.1$	−0.1		$+V_S - 2.2$	V

Parameter	Test Conditions	A Grade Min	Typ	Max	B Grade Min	Typ	Max	W Grade Min	Typ	Max	Unit
OUTPUT											
Output Swing	R_L = 10 kΩ	0.15		4.85	0.15		4.85	0.15		4.85	V
Over Temperature	T_{OPR}	0.2		4.80	0.2		4.80	0.3		4.70	V
Short-Circuit Current			15			15			15		mA
REFERENCE INPUT	T_A										
R_{IN}			40			40			40		kΩ
I_{IN}	$V_{IN}+$, $V_{IN}-$ = 0 V			70			70			70	μA
Voltage Range		$-V_S$		$+V_S$	$-V_S$		$+V_S$	$-V_S$		$+V_S$	V
Gain to Output	T_A		1 ± 0.0001			1 ± 0.0001			1 ± 0.0001		V/V
POWER SUPPLY											
Operating Range		4.5		36	4.5		36	4.5		36	V
Quiescent Current	T_A			750			750			750	μA
Over Temperature	T_{OPR}			850			850			1000	μA
TEMPERATURE RANGE											
T_{OPR}, For Specified Performance	T_{OPR}	−40		+85	−40		+85	−40		+125	°C

[1] When the output sinks more than 4 mA, use a 47 pF capacitor in parallel with the load to prevent ringing. Otherwise, use a larger load, such as 10 kΩ.
[2] Differential and common-mode impedance can be calculated from the pin impedance: $Z_{DIFF} = 2(Z_{PIN})$; $Z_{CM} = Z_{PIN}/2$.
[3] The AD8220 can operate up to a diode drop below the negative supply but the bias current increases sharply. The input voltage range reflects the maximum allowable voltage where the input bias current is within the specification.

ABSOLUTE MAXIMUM RATINGS

Table 3.

Parameter	Rating
Supply Voltage	±18 V
Power Dissipation	See Figure 3
Output Short-Circuit Current	Indefinite[1]
Input Voltage (Common Mode)	±Vs
Differential Input Voltage	±Vs
Storage Temperature Range	−65°C to +125°C
Operating Temperature Range[2]	−40°C to +125°C
Lead Temperature (Soldering 10 sec)	300°C
Junction Temperature	140°C
θ_{JA} (4-Layer JEDEC Standard Board)	135°C/W
Package Glass Transition Temperature	140°C
ESD (Human Body Model)	4 kV
ESD (Charge Device Model)	1 kV
ESD (Machine Model)	0.4 kV

[1] Assumes the load is referenced to midsupply.
[2] Temperature for specified performance is −40°C to +85°C. For performance to 125°C, see the Typical Performance Characteristics section.

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

Figure 3 shows the maximum safe power dissipation in the package vs. the ambient temperature for the MSOP on a 4-layer JEDEC standard board. θ_{JA} values are approximations.

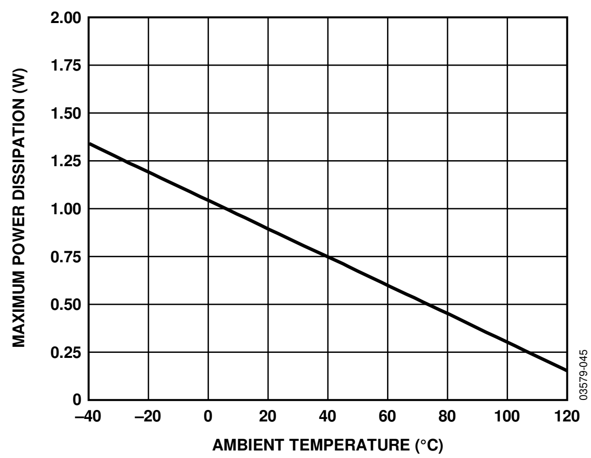

Figure 3. Maximum Power Dissipation vs. Ambient Temperature

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

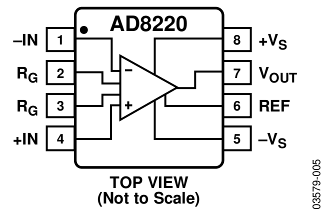

Figure 4. Pin Configuration

Table 4. 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

TYPICAL PERFORMANCE CHARACTERISTICS

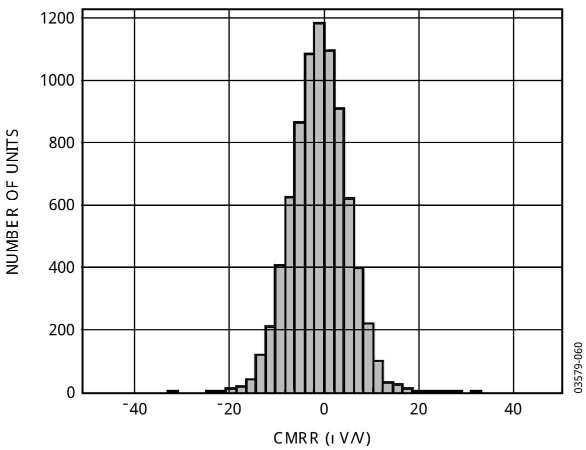

Figure 5. Typical Distribution of CMRR (G = 1)

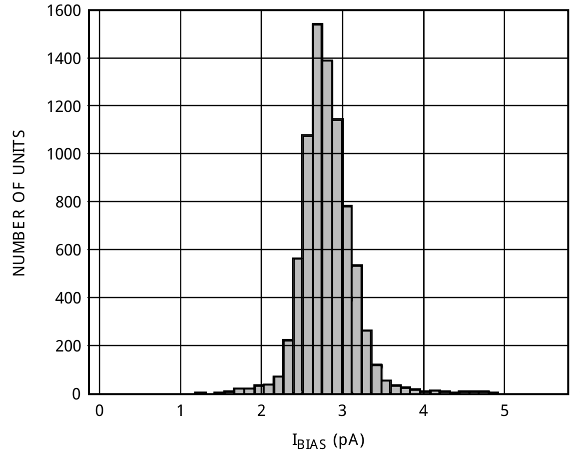

Figure 8. Typical Distribution of Input Bias Current

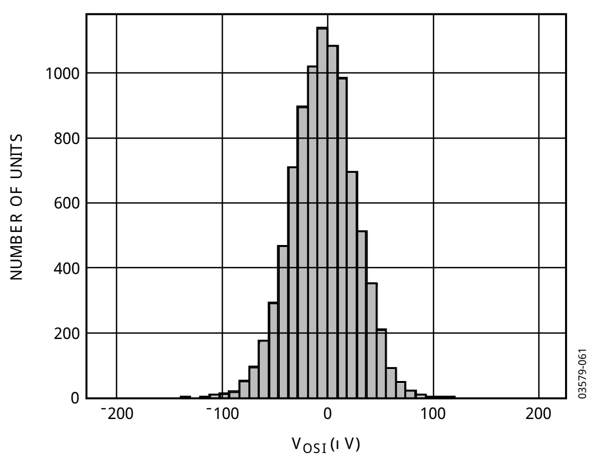

Figure 6. Typical Distribution of Input Offset Voltage

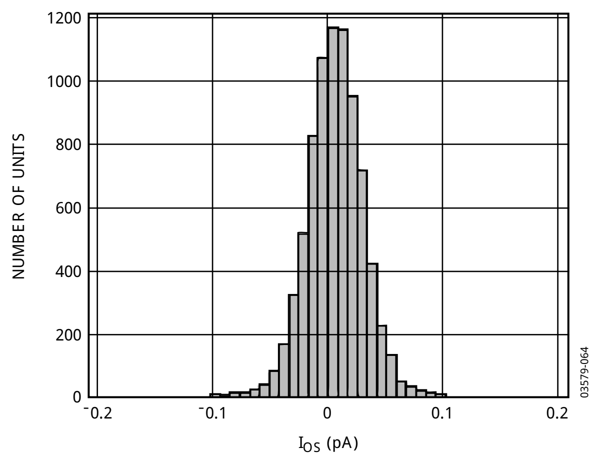

Figure 9. Typical Distribution of Input Offset Current

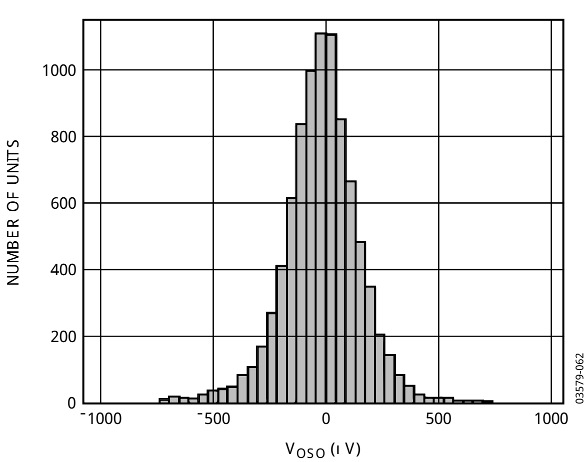

Figure 7. Typical Distribution of Output Offset Voltage

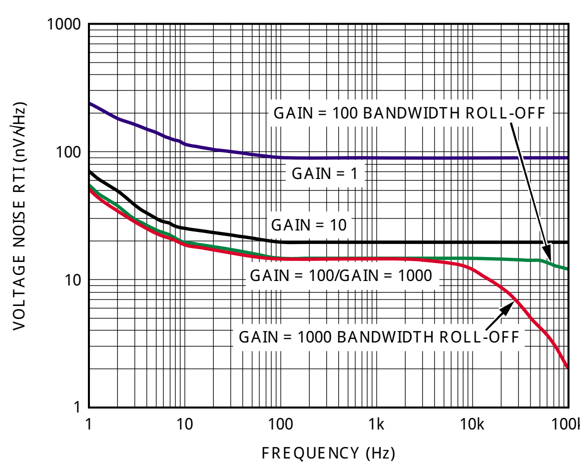

Figure 10. Voltage Spectral Density vs. Frequency

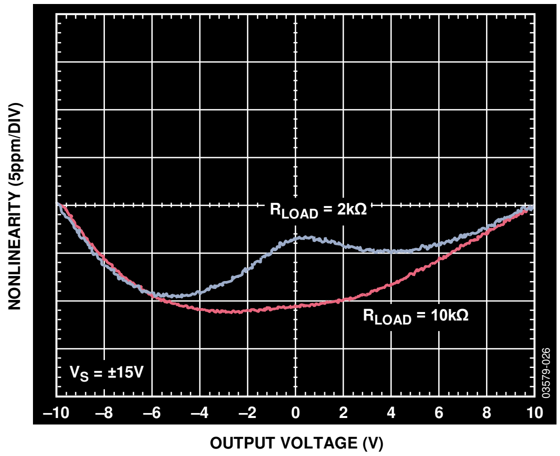

Figure 23. Gain Nonlinearity, G = 1

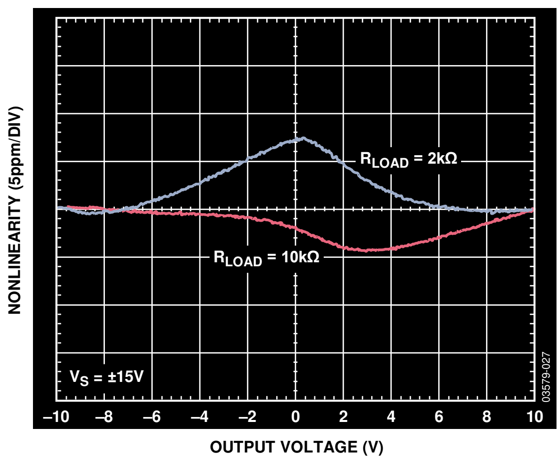

Figure 24. Gain Nonlinearity, G = 10

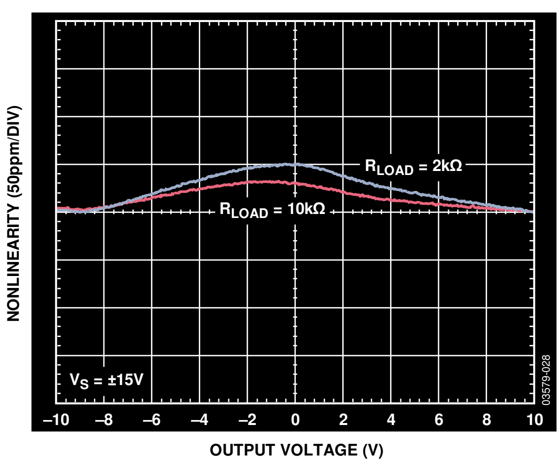

Figure 25. Gain Nonlinearity, G = 100

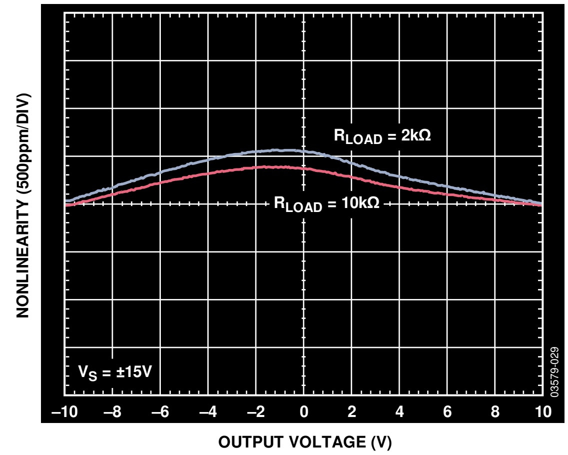

Figure 26. Gain Nonlinearity, G = 1000

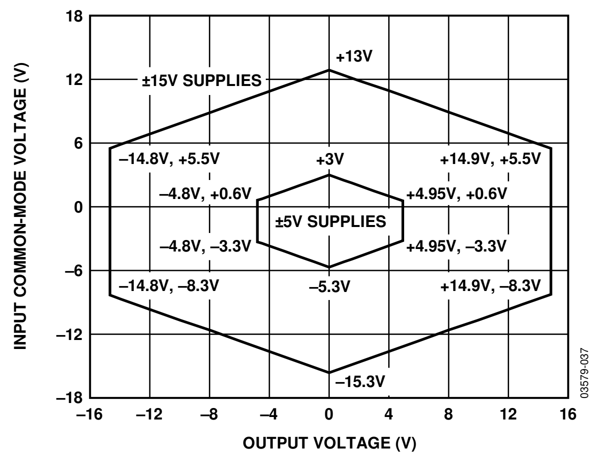

Figure 27. Input Common-Mode Voltage Range vs. Output Voltage, G = 1, V_{REF} = 0 V

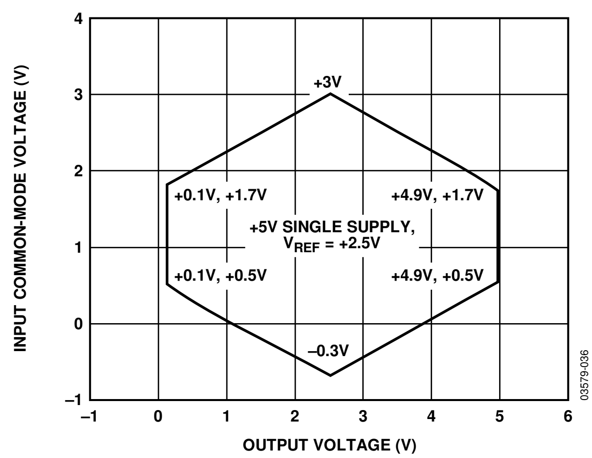

Figure 28. Input Common-Mode Voltage Range vs. Output Voltage, G = 1, V_S = +5 V, V_{REF} = 2.5 V

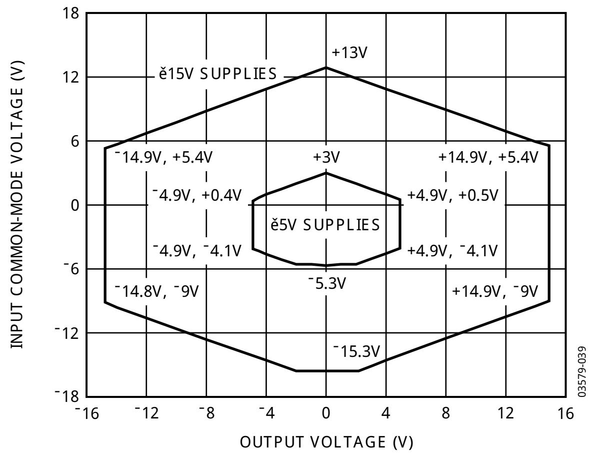

Figure 29. Input Common-Mode Voltage Range vs. Output Voltage, G = 100, V_{REF} = 0 V

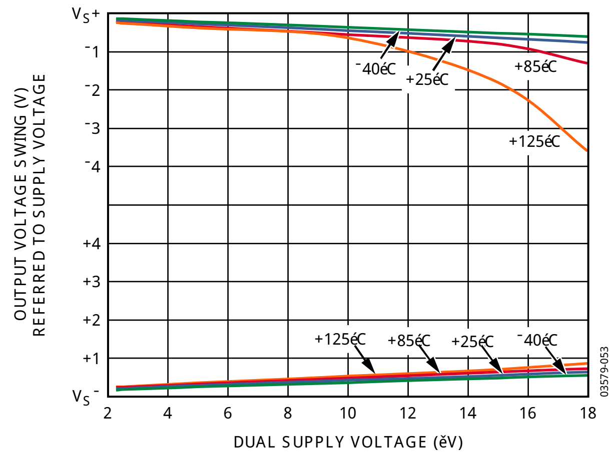

Figure 32. Output Voltage Swing vs. Supply Voltage, R_{LOAD} = 2 kΩ, G = 10, V_{REF} = 0 V

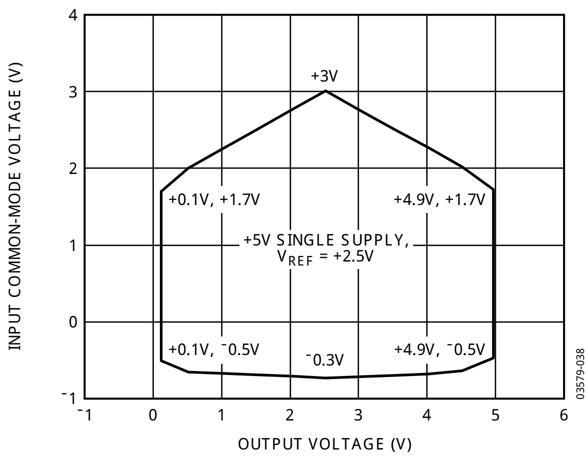

Figure 30. Input Common-Mode Voltage Range vs. Output Voltage, G = 100, V_S = +5 V, V_{REF} = 2.5 V

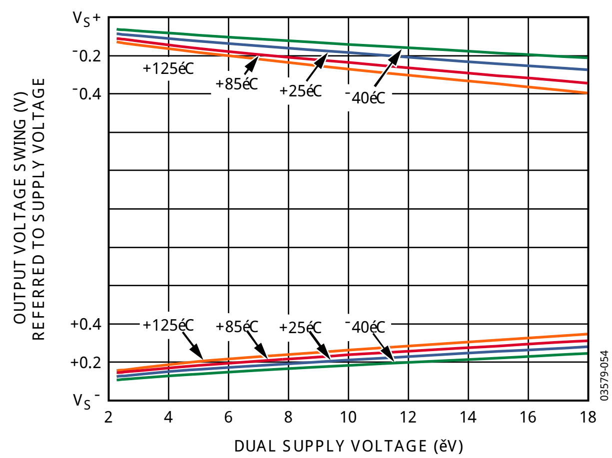

Figure 33. Output Voltage Swing vs. Supply Voltage, R_{LOAD} = 10 kΩ, G = 10, V_{REF} = 0 V

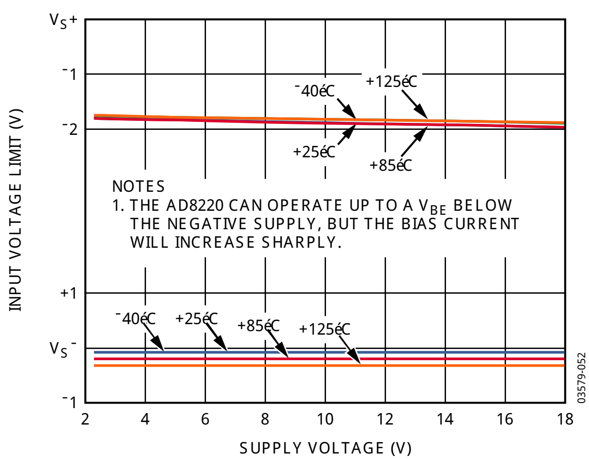

Figure 31. Input Voltage Limit vs. Supply Voltage, G = 1, V_{REF} = 0 V

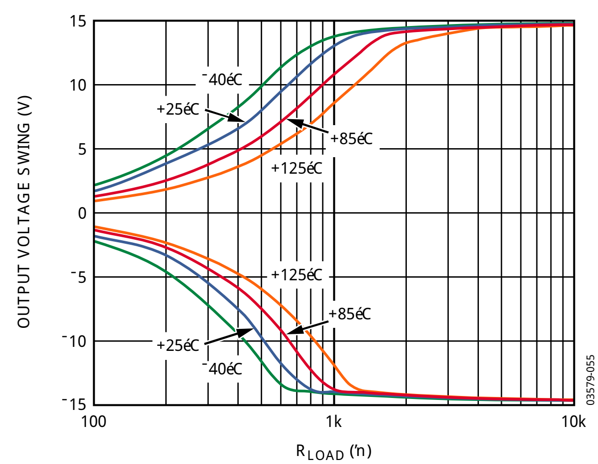

Figure 34. Output Voltage Swing vs. Load Resistance V_S = ±15 V, V_{REF} = 0 V

ELECTROCARDIOGRAM SIGNAL CONDITIONING

The AD8220 makes an excellent input amplifier for next generation ECGs. Its small size, high CMRR over frequency, rail-to-rail output, and JFET inputs are well suited for this application. Potentials measured on the skin range from 0.2 mV to 2 mV. The AD8220 solves many of the typical challenges of measuring these body surface potentials. The high CMRR of the AD8220 helps reject common-mode signals that come in the form of line noise or high frequency EMI from equipment in the operating room. Its rail-to-rail output offers a wide dynamic range allowing for higher gains than would be possible using other instrumentation amplifiers. JFET inputs offer a large input capacitance of 5 pF. A natural RC filter is formed reducing high frequency noise when series input resistors are used in front of the AD8220 (see the RF Interference section).

In addition, the AD8220 JFET inputs have ultralow input bias current and no current noise, making it useful for ECG applications where there are often large impedances. The MSOP and the optimal pinout of the AD8220 allow smaller footprints and more efficient layout, paving the way for next-generation portable ECGs.

Figure 67 shows an example ECG schematic. Following the AD8220 is a 0.033 Hz high-pass filter, formed by the 4.7 µF capacitor and the 1 MΩ resistor, which removes the dc offset that develops between the electrodes. An additional gain of 50, provided by the AD8618, makes use of the 0 V to 5 V input range of the ADC. An active, fifth-order, low-pass Bessel filter removes signals greater than approximately 160 Hz. An OP2177 buffers, inverts, and gains the common-mode voltage taken at the midpoint of the AD8220 gain setting resistors. This right-leg drive circuit helps cancel common-mode signals by inverting the common-mode signal and driving it back into the body. A 499 kΩ series resistor at the output of the OP2177 limits the current driven into the body.

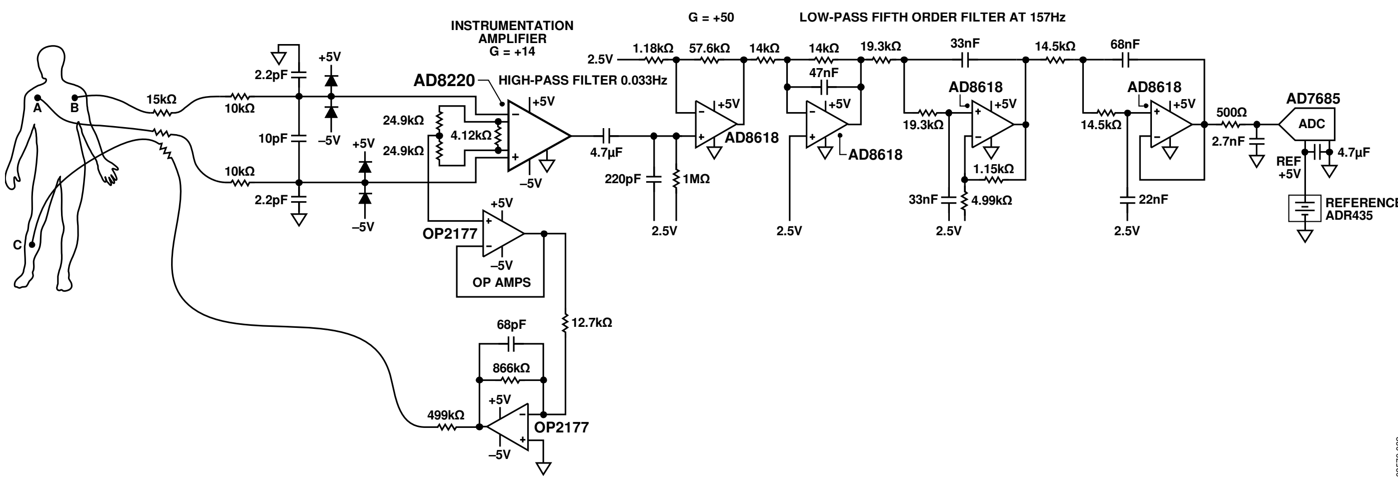

Figure 67. Example ECG Schematic

OUTLINE DIMENSIONS

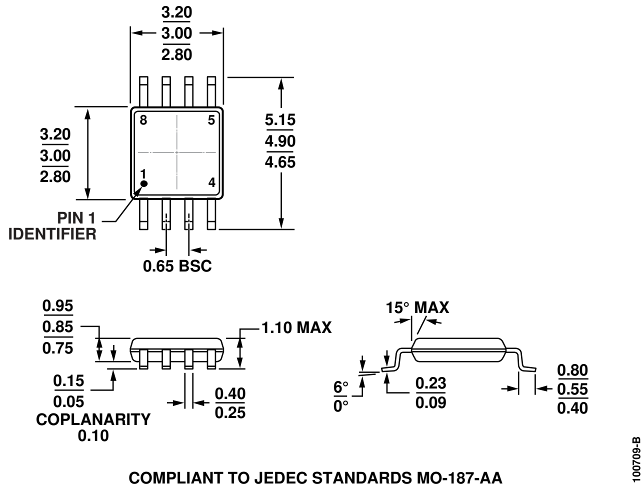

Figure 68. 8-Lead Mini Small Outline Package [MSOP]
(RM-8)
Dimensions shown in millimeters

ORDERING GUIDE

Model[1, 2]	Temperature Range[3]	Package Description	Package Option	Marking Code
AD8220ARMZ	−40°C to +85°C	8-Lead MSOP	RM-8	H01
AD8220ARMZ-R7	−40°C to +85°C	8-Lead MSOP, 7" Tape and Reel	RM-8	H01
AD8220BRMZ	−40°C to +85°C	8-Lead MSOP	RM-8	H0P
AD8220BRMZ-RL	−40°C to +85°C	8-Lead MSOP, 13" Tape and Reel	RM-8	H0P
AD8220BRMZ-R7	−40°C to +85°C	8-Lead MSOP, 7" Tape and Reel	RM-8	H0P
AD8220WARMZ	−40°C to +125°C	8-Lead MSOP	RM-8	Y2D
AD8220WARMZ-RL	−40°C to +125°C	8-Lead MSOP, 13" Tape and Reel	RM-8	Y2D
AD8220WARMZ-R7	−40°C to +125°C	8-Lead MSOP, 7" Tape and Reel	RM-8	Y2D

[1] Z = RoHS Compliant Part.
[2] W = Qualified for Automotive Applications.
[3] See the Typical Performance Characteristics section for expected operation from 85°C to 125°C.

AUTOMOTIVE PRODUCTS

The AD8220W models are available with controlled manufacturing to support the quality and reliability requirements of automotive applications. Note that these automotive models may have specifications that differ from the commercial models; therefore, designers should review the Specifications section of this data sheet carefully. Only the automotive grade products shown are available for use in automotive applications. Contact your local Analog Devices account representative for specific product ordering information and to obtain the specific Automotive Reliability reports for these models.

NOTES

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