



20 μ A Maximum, Rail-to-Rail I/O, Zero Input, Crossover Distortion Amplifiers

Preliminary Technical Data

AD8508

FEATURES

PSRR: 100 dB minimum

CMRR: 105 dB typical

Very low supply current: 20 μ A per amp maximum

1.8 V to 5 V single-supply or ± 0.9 V to ± 2.5 V dual-supply
operation

Rail-to-rail input and output

2.5 mV offset voltage maximum

Very low input bias current: 1 pA typical

APPLICATIONS

Pressure and position sensors

Remote security

Bio sensors

IR thermometers

Battery-powered consumer equipment

Hazard detectors

GENERAL DESCRIPTION

The AD8508 is a quad micropower amplifiers featuring rail-to-rail input and output swings while operating from a 1.8 V to 5 V single or from ± 0.9 V to ± 2.5 V dual power supply.

Using a novel circuit technology, these low cost amplifiers offer zero crossover distortion (excellent PSRR and CMRR performance) and very low bias current, while operating with a supply current of less than 20 μ A per amplifier. This amplifier offers the lowest noise in its power class.

This combination of features makes the AD8508 amplifiers ideal choices for battery-powered applications because they minimize errors due to power supply voltage variations over the lifetime of the battery and maintain high CMRR even for a rail-to-rail input op amp.

PIN CONFIGURATION

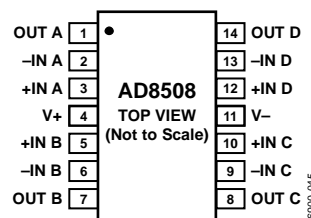


Figure 1. 14-Lead TSSOP (RU-14)

Remote battery-powered sensors, handheld instrumentation and consumer equipment, hazard detection (for example, smoke, fire, and gas), and patient monitors can benefit from the features of the AD8508 amplifiers.

The AD8508 are specified for both the industrial temperature range of -40°C to $+85^{\circ}\text{C}$ and the extended industrial temperature range of -40°C to $+125^{\circ}\text{C}$. The AD8508 quad amplifiers are available in the 14-lead TSSOP package.

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One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700
Fax: 781.461.3113
www.analog.com
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SPECIFICATIONS

ELECTRICAL CHARACTERISTICS—5 V OPERATION

$V_{SY} = 5\text{ V}$, $V_{CM} = V_{SY}/2$, $T_A = 25^\circ\text{C}$, $R_L = 100\text{ k}\Omega$ to GND, unless otherwise noted.

Table 1.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Offset Voltage	V _{OS}	0 V ≤ V _{CM} ≤ 5 V −40°C ≤ T _A ≤ +125°C		0.5	2.5 3.5	mV mV
Input Bias Current	I _B	−40°C ≤ T _A ≤ +85°C −40°C ≤ T _A ≤ +125°C		1	10 100	pA pA
Input Offset Current	I _{OS}	−40°C ≤ T _A ≤ +85°C −40°C ≤ T _A ≤ +125°C		0.5	600 5	pA pA
Input Voltage Range		−40°C ≤ T _A ≤ +85°C −40°C ≤ T _A ≤ +125°C −40°C ≤ T _A ≤ +125°C	0		5	V
Common-Mode Rejection Ratio	CMRR	0 V ≤ V _{CM} ≤ 5 V −40°C ≤ T _A ≤ +85°C −40°C ≤ T _A ≤ +125°C	90 90 85	105		dB dB dB
Large Signal Voltage Gain	A _{VO}	0.05 V ≤ V _{OUT} ≤ 4.95 V −40°C ≤ T _A ≤ +125°C −40°C ≤ T _A ≤ +125°C	105 100	120		dB dB
Offset Voltage Drift	ΔV _{OS} /ΔT	−40°C ≤ T _A ≤ +125°C		2		μV/°C
Input Capacitance Differential Mode	C _{DIFF}			3		pF
Input Capacitance Common Mode	C _{CM}			4.2		pF
OUTPUT CHARACTERISTICS						
Output Voltage High	V _{OH}	R _L = 100 kΩ to GND −40°C ≤ T _A ≤ +125°C R _L = 10 kΩ to GND −40°C ≤ T _A ≤ +125°C	4.98 4.98 4.9 4.9	4.99 4.95		V V V V
Output Voltage Low	V _{OL}	R _L = 100 kΩ to V _{SY} −40°C ≤ T _A ≤ +125°C R _L = 10 kΩ to V _{SY} −40°C ≤ T _A ≤ +125°C		2 10	5 5 25 30	mV mV mV mV
Short-Circuit Limit	I _{SC}			±55		mA
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V _{SY} = 1.8 V to 5 V −40°C ≤ T _A ≤ +85°C −40°C ≤ T _A ≤ +125°C	100 100 95	110		dB dB dB
Supply Current per Amplifier	I _{SY}	V _{OUT} = V _{SY} /2 −40°C ≤ T _A ≤ +125°C		15	20 25	μA μA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R _L = 100 kΩ, C _L = 10 pF, G = 1		13		mV/μs
Gain Bandwidth Product	GBP	R _L = 1 MΩ, C _L = 20 pF, G = 1		95		kHz
Phase Margin	Φ _M	R _L = 1 MΩ, C _L = 20 pF, G = 1		60		Degrees
NOISE PERFORMANCE						
Voltage Noise	e _n p-p	f = 0.1 Hz to 10 Hz		2.8		μV p-p
Voltage Noise Density	e _n	f = 1 kHz		45		nV/√Hz
Current Noise Density	i _n	f = 1 kHz		15		fA/√Hz

ELECTRICAL CHARACTERISTICS—1.8 V OPERATION

$V_{SY} = 1.8 \text{ V}$, $V_{CM} = V_{SY}/2$, $T_A = 25^\circ\text{C}$, $R_L = 100 \text{ k}\Omega$ to GND, unless otherwise noted.

Table 2.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Offset Voltage	V _{OS}	0 V ≤ V _{CM} ≤ 1.8 V −40°C ≤ T _A ≤ +125°C		0.5	2.5	mV
Input Bias Current	I _B	−40°C ≤ T _A ≤ +85°C −40°C ≤ T _A ≤ +125°C		1	3.5	mV
					10	pA
					100	pA
Input Offset Current	I _{OS}	−40°C ≤ T _A ≤ +85°C −40°C ≤ T _A ≤ +125°C		0.5	600	pA
					5	pA
					50	pA
Input Voltage Range		−40°C ≤ T _A ≤ +125°C	0		100	V
Common-Mode Rejection Ratio	CMRR	0 V ≤ V _{CM} ≤ 1.8 V	85	100		dB
		−40°C ≤ T _A ≤ +85°C	85			dB
		−40°C ≤ T _A ≤ +125°C	80			dB
Large Signal Voltage Gain	A _{VO}	0.05 V ≤ V _{OUT} ≤ 1.75 V	95	115		dB
		−40°C ≤ T _A ≤ +125°C	95			dB
Offset Voltage Drift	ΔV _{OS} /ΔT	−40°C ≤ T _A ≤ +125°C		2.5		μV/°C
Input Capacitance Differential Mode	C _{DIFF}			3		pF
Input Capacitance Common Mode	C _{CM}			4.2		pF
OUTPUT CHARACTERISTICS						
Output Voltage High	V _{OH}	R _L = 100 kΩ to GND	1.78	1.79		V
		−40°C ≤ T _A ≤ +125°C	1.78			V
		R _L = 10 kΩ to GND	1.65	1.75		V
		−40°C ≤ T _A ≤ +125°C	1.65			V
Output Voltage Low	V _{OL}	R _L = 100 kΩ to V _{SY}		2	5	mV
		−40°C ≤ T _A ≤ +125°C			5	mV
		R _L = 10 kΩ to V _{SY}		12	25	mV
		−40°C ≤ T _A ≤ +125°C			25	mV
Short-Circuit Limit	I _{SC}			±6.5		mA
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V _{SY} = 1.8 V to 5 V	100	110		dB
		−40°C ≤ T _A ≤ +85°C	100			dB
		−40°C ≤ T _A ≤ +125°C	95			dB
Supply Current per Amplifier	I _{SY}	V _{OUT} = V _{SY} /2		16.5	20	μA
		−40°C ≤ T _A ≤ +125°C			25	μA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R _L = 100 kΩ, C _L = 10 pF, G = 1		13		mV/μs
Gain Bandwidth Product	GBP	R _L = 1 MΩ, C _L = 20 pF, G = 1		95		kHz
Phase Margin	Φ _M	R _L = 1 MΩ, C _L = 20 pF, G = 1		60		Degrees
NOISE PERFORMANCE						
Voltage Noise	e _n p-p	f = 0.1 Hz to 10 Hz		2.8		μV p-p
Voltage Noise Density	e _n	f = 1 kHz		45		nV/√Hz
Current Noise Density	i _n	f = 1 kHz		15		fA/√Hz

ABSOLUTE MAXIMUM RATINGS

Table 3.

Parameter	Rating
Supply Voltage	5.5 V
Input Voltage	$\pm V_{SY} \pm 0.1$ V
Input Current ¹	± 10 mA
Differential Input Voltage ²	$\pm V_{SY}$
Output Short-Circuit Duration to GND	Indefinite
Storage Temperature Range	–65°C to +150°C
Operating Temperature Range	–40°C to +125°C
Junction Temperature Range	–65°C to +150°C
Lead Temperature (Soldering, 60 sec)	300°C

¹ Input pins have clamp diodes to the supply pins. Input current should be limited to 10 mA or less whenever the input signal exceeds the power supply rail by 0.5 V.

² Differential input voltage is limited to 5 V or the supply voltage, whichever is less.

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

THERMAL RESISTANCE

θ_{JA} is specified for the worst-case conditions, that is, a device soldered in a circuit board for surface-mount packages. This was measured using a standard two-layer board.

Table 4. Thermal Resistance

Package Type	θ_{JA}	θ_{JC}	Unit
8-Lead MSOP (RM-8)	190	44	°C/W
14-Lead TSSOP (RU-14)	180	35	°C/W

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.