8.7MHz, 15nV/√Hz, Rail-to-Rail I/O, Zero Input Crossover Distortion Amplifiers

Preliminary Technical Data

ADA4500-2

FEATURES

PSRR: 100dB minimum
CMRR: 100 dB minimum
Supply current: 1.6 mA/amp max
Wide Bandwidth: 8.7 MHz
2.7 V to 5.5 V single-supply operation
Rail-to-rail input and output
Low noise
  1.1 µV p-p from 0.1 Hz to 10 Hz
  15nV/√Hz @ 1kHz
150 µV offset voltage maximum
Very low input bias current: 10 pA maximum

APPLICATIONS

Pressure and position sensors
Remote security
Medical monitors
Process control
Hazard detectors
Photo Diode applications

GENERAL DESCRIPTION

The ADA4500 is a dual 8.7MHz, 15 nV/√Hz, low power amplifier featuring rail-to-rail input and output swings while operating from a 2.7 V to 5.5 V single power supply.

Employing a novel circuit technology, these amplifiers offer zero input crossover distortion (high linearity and excellent PSRR and CMRR performance), precision, wide bandwidth and very low bias current. This technology offer the excellent CMRR over the supply range without the cross-over distortion seen with the traditional complementary input stage.

This combination of these features makes the ADA4500 amplifier an ideal choice for precision sensor applications as it minimizes errors due to power supply voltage variations over the supply voltage and maintains high CMRR even for a rail-to-rail input op amp. This results in excellent performance for driving Analog-to-Digital (A/D) converters without degradation of performance. The input common mode range includes both the negative and positive supplies.

Sensors, handheld instrumentation, precision signal conditioning, and patient monitors can benefit from the features of the ADA4500.

The ADA4500 is specified for the extended industrial temperature range (−40°C to +125°C). ADA4500-2 dual amplifiers are available in the standard 8-lead MSOP and LFCSP.

PIN CONFIGURATIONS

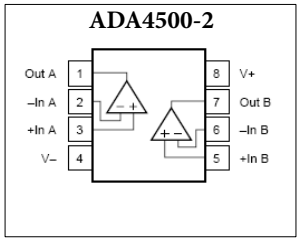

Figure 1. 8-Lead MSOP& LFCSP (RM & CP Suffix)

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SPECIFICATIONS

ELECTRICAL CHARACTERISTICS; V_S = 2.7V

V_S = 2.7 V, V_{CM} = Vs/2, T_A = 25°C, R_L = 10kΩ, C_L = 30 pF, unless otherwise specified.

Table 1.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	0 V < V_{CM} < 2.7 V			150	µV
Input Bias Current	I_B			1	10	pA
		−40°C < T_A < +125°C			600	pA
Input Offset Current	I_{OS}			0.5	1	pA
		−40°C < T_A < +125°C			100	pA
Input Voltage Range		−40°C < T_A < +125°C	(V-) -0.3		(V+) + 0.3	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = V- to V+	100	110		dB
		−40°C < T_A < +125°C	100			dB
Large Signal Voltage Gain	A_{VO}	(V-) + 0.05 < V_{OUT} < (V+) - 0.05	110	130		dB
		−40°C < T_A < +125°C	105			dB
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40°C < T_A < +125°C		0.2	5	µV/°C
Input Capacitance						
Common-Mode Input Capacitance				3		pF
Differential Input Capacitance				2		pF
Input Impedance				TBD		MΩ
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	R_L = 10 kΩ to GND	2.95	2.97		V
		R_L = 2 kΩ to GND	2.90	2.95		V
Output Voltage Low	V_{OL}	R_L = 10 kΩ to V_S		10	50	mV
		R_L = 2 kΩ to V_S		25	100	mV
Short Circuit Limit	I_{SC}			+20/-40		mA
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 2.7 V to 5.5 V	100	110		dB
		−40°C to +125°C	100			dB
Supply Current/Amplifier	I_{SY}	V_O = V_S /2		1.35	1.6	mA
		−40°C < T_A < +125°C			1.9	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR			4.7		V/µs
Gain Bandwidth Product	GBP			8.6		MHz
Phase Margin	Φ_M			55		Degrees
NOISE PERFORMANCE						
Total Harmonic Distortion + Noise	THD+N	V_S = 2.7 V, G= +1, f = 20Hz to 20kHz		0.002		%
Peak-to-Peak Noise	$e_{n\ p\text{-}p}$	f = 0.1 to 10 Hz		1.1		µV p-p
Voltage Noise Density	e_n	f = 1 kHz		15		nV/√Hz
Current Noise Density	i_n	f = 1 kHz		0.5		fA/√Hz

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ELECTRICAL CHARACTERISTICS; V_S = 5V

V_S = 5 V, V_{CM} = Vs/2, T_A = 25°C, R_L = 10kΩ, C_L = 30 pF, unless otherwise specified.

Table 2.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	0 V < V_{CM} < 5 V			150	µV
Input Bias Current	I_B			1	10	pA
		−40°C < T_A < +125°C			600	pA
Input Offset Current	I_{OS}			0.5	1	pA
		−40°C < T_A < +125°C			100	pA
Input Voltage Range		−40°C < T_A < +125°C	(V-) -0.3		(V+) + 0.3	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = V- to V+	100	110		dB
		−40°C < T_A < +125°C	100			dB
Large Signal Voltage Gain	A_{VO}	(V-) + 0.05 < V_{OUT} < (V+) - 0.05	110	130		dB
		−40°C < T_A < +125°C	100			dB
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40°C < T_A < +125°C		0.2	5	µV/°C
Input Capacitance						
Common-Mode Input Capacitance				3		pF
Differential Input Capacitance				2		pF
Input Impedance				TBD		MΩ
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	R_L = 10 kΩ to GND	4.95	4.97		V
		R_L = 2 kΩ to GND	4.90	4.95		V
Output Voltage Low	V_{OL}	R_L = 10 kΩ to V_S		5	10	mV
		R_L = 2 kΩ to V_S		25	30	mV
Short Circuit Limit	I_{SC}			±50		mA
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 2.7 V to 5.5 V	100	110		dB
		−40°C to +125°C	100			dB
Supply Current/Amplifier	I_{SY}	V_O = V_S /2		1.5	1.6	mA
		−40°C < T_A < +125°C			1.9	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR			5.2		V/µs
Gain Bandwidth Product	GBP			8.7		MHz
Phase Margin	Φ_M			54		Degrees
NOISE PERFORMANCE						
Total Harmonic Distortion + Noise	THD+N	V_S = 5 V, G= +1, f = 20Hz to 20kHz		0.002		%
Peak-to-Peak Noise	$e_{n\,p-p}$	f = 0.1 to 10 Hz		1.1		µV p-p
Voltage Noise Density	e_n	f = 1 kHz		15		nV/√Hz
Current Noise Density	i_n	f = 1 kHz		0.5		fA/√Hz

ABSOLUTE MAXIMUM RATINGS

Table 3.

Parameter	Rating
Supply Voltage	6 V
Input Voltage	$-V_S$ – 0.3V, $+V_S$ +0.3V
Differential Input Voltage[1]	$-V_S$ – 0.6V, $+V_S$ +0.6V
Output Short-Circuit Duration to Gnd	Indefinite
Storage Temperature Range RM, CP Packages	−65°C to +150°C
Operating Temperature Range	−40°C to +125°C
Junction Temperature Range RM, CP Packages	−65°C to +150°C
Lead Temperature (Soldering, 60 sec)	300°C

[1] Differential input voltage is limited to 5.6 V or the supply voltage+0.6V, 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.

Table 4. Thermal Resistance

Package Type	θ_{JA}	θ_{JC}	Unit
8-Lead MSOP (RM-8)	TBD	TBD	°C/W
8-Lead LFCSP (CP-8)	TBD	TBD	°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.

PR10617-0-2/12(PrA)