

PRELIMINARY TECHNICAL DATA

a

Zero-Drift, Single-Supply, Rail-to-Rail Input/Output Low Noise Operational Amplifier

Preliminary Technical Data

AD8628

FEATURES

- Lowest auto-zero amplifier noise
- Low Offset Voltage: 5 μV
- Input Offset Drift: 0.03 $\mu\text{V}/^\circ\text{C}$
- Rail-to-Rail Input and Output Swing
- 5 V Single-Supply Operation
- High Gain, CMRR, and PSRR: 120 dB
- Very Low Input Bias Current: 100 pA
- Low Supply Current: 1.3 mA
- Overload Recovery Time: 0.2 ms
- No External Components Required

APPLICATIONS

- Automotive Sensors
- Pressure and Position Sensors
- Strain Gage Amplifiers
- Medical Instrumentation
- Thermocouple Amplifiers

GENERAL DESCRIPTION

This new family of amplifiers has ultra-low offset, drift and bias current. The AD8628 is a wide bandwidth auto-zero amplifier featuring rail-to-rail input and output swings and low noise. Operation is fully specified from 2.7 to 5 volts single supply ($\pm 1.35\text{V}$ to $\pm 2.5\text{V}$ dual supply).

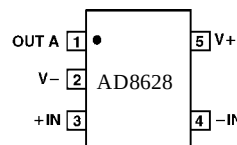
The AD8628 family provides the benefits previously found only in expensive auto-zeroing or chopper-stabilized amplifiers. Using Analog Devices' new topology these zero-drift amplifiers combine low cost, with high accuracy and low noise. (No external capacitors are required.) In addition, the AD8628 greatly reduces the digital switching noise found in most chopper stabilized amplifiers.

With an offset voltage of only 1 μV , drift less than 0.005 $\mu\text{V}/^\circ\text{C}$ and noise of only 0.5 μV P-P (0Hz to 10 Hz) the AD8628 is perfectly suited for applications where error sources cannot be tolerated. Position and pressure sensors, medical equipment, and strain gage amplifiers benefit greatly from nearly zero drift over their operating temperature range. Many systems may take advantage of the rail-to-rail input and output swings provided by

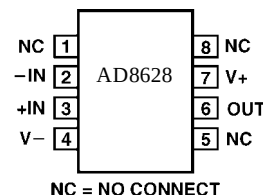
the AD8628 family to reduce input biasing complexity and maximize SNR.

The AD8628 family is specified for the extended industrial (-40° to $+125^\circ\text{C}$) temperature range. The AD8628 amplifier is available in the tiny SOT23 and the popular 8-pin narrow SOIC plastic packages.

5-Lead SOT
(RT-5)



8-Lead SO
(R-8)



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AD8628

ELECTRICAL SPECIFICATIONS (@ $V_S=+5.0V$, $V_{CM} = +2.5V$, $V_O=+2.5V$, $T_A=+25^\circ C$ unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	$-40^\circ C \leq T_A \leq +125^\circ C$		1	5	μV
Input Bias Current	I_B	$-40^\circ C \leq T_A \leq +125^\circ C$		30	100	pA
Input Offset Current	I_{OS}	$-40^\circ C \leq T_A \leq +125^\circ C$		50	200	pA
Input Voltage Range		$-40^\circ C \leq T_A \leq +125^\circ C$	0		5	V
Common-Mode Rejection Ratio	CMRR	$V_{CM} = 0V$ to $5V$ $-40^\circ C \leq T_A \leq +125^\circ C$	120	140		dB
Large Signal Voltage Gain (Note 1)	A_{VO}	$R_L = 10\text{ k}\Omega$, $V_O=0.3$ to $4.7V$ $-40^\circ C \leq T_A \leq +125^\circ C$	115	130		dB
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	$-40^\circ C \leq T_A \leq +125^\circ C$		125	135	dB
				0.002	0.03	$\mu V/^\circ C$
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	$R_L = 100\text{ k}\Omega$ to Ground $-40^\circ C \leq T_A \leq +125^\circ C$	4.99	4.996		V
		$R_L = 10\text{ k}\Omega$ to Ground $-40^\circ C \leq T_A \leq +125^\circ C$	4.95	4.98		V
Output Voltage Low	V_{OL}	$R_L = 100\text{ k}\Omega$ to $V+$ $-40^\circ C \leq T_A \leq +125^\circ C$	4.95	4.97		V
		$R_L = 10\text{ k}\Omega$ to $V+$ $-40^\circ C \leq T_A \leq +125^\circ C$		1	10	mV
				2	10	mV
				10	20	mV
Short Circuit Limit	I_{SC}	$-40^\circ C \leq T_A \leq +125^\circ C$	± 25	± 50	20	mV
Output Current	I_O	$-40^\circ C \leq T_A \leq +125^\circ C$		± 40		mV
		$-40^\circ C \leq T_A \leq +125^\circ C$		± 30		mV
		$-40^\circ C \leq T_A \leq +125^\circ C$		± 15		mV
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	$V_S = 2.7V$ to $5.5V$ $-40^\circ C \leq T_A \leq +125^\circ C$	120	130		dB
Supply Current/Amplifier	I_{SY}	$V_O = 0V$ $-40^\circ C \leq T_A \leq +125^\circ C$	115	130		dB
				1.3	1.5	mA
				1.6	1.8	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	$R_L = 10\text{ k}\Omega$		0.8		V/ μs
Overload Recovery Time				0.05	0.2	ms
Gain Bandwidth Product	GBP			2.5		MHz
NOISE PERFORMANCE						
Voltage Noise	$e_{n\text{ p-p}}$	0.1 to 10 Hz		0.5		$\mu V_{\text{p-p}}$
Voltage Noise	$e_{n\text{ p-p}}$	0.1 to 1.0 Hz		0.16		$\mu V_{\text{p-p}}$
Voltage Noise Density	e_n	$f = 1\text{ kHz}$		22		nV/ $\sqrt{\text{Hz}}$
Current Noise Density	i_n	$f=10\text{ Hz}$		5		fA/ $\sqrt{\text{Hz}}$

Note 1: Gain testing is highly dependent upon test bandwidth.

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ELECTRICAL SPECIFICATIONS (@ $V_S=+2.7V$, $V_{CM}=+1.35V$, $V_O=1.4V$, $T_A=+25^\circ C$ unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage AD8628	V_{OS}	$-40^\circ C \leq T_A \leq +125^\circ C$		1	5	μV
Input Bias Current	I_B	$-40^\circ C \leq T_A \leq +125^\circ C$		30	100	μA
Input Offset Current	I_{OS}	$-40^\circ C \leq T_A \leq +125^\circ C$		1.0	1.5	nA
Input Voltage Range		$-40^\circ C \leq T_A \leq +125^\circ C$		50	200	pA
Common-Mode Rejection Ratio	CMRR	$V_{CM} = 0$ to 2.9V	0		5	V
		$-40^\circ C \leq T_A \leq +125^\circ C$	115	130		dB
Large Signal Voltage Gain	A_{VO}	$R_L = 10 k\Omega$, $V_O=0.3$ to 4.7V	110	120		dB
		$-40^\circ C \leq T_A \leq +125^\circ C$	105	130		dB
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	$-40^\circ C \leq T_A \leq +125^\circ C$		0.002	0.03	$\mu V/^\circ C$
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	$R_L = 100k\Omega$ to Ground	2.68	2.695		V
		$-40^\circ C \leq T_A \leq +125^\circ C$	2.68	2.695		V
		$R_L = 10k\Omega$ to Ground	2.67	2.68		V
		$-40^\circ C \leq T_A \leq +125^\circ C$	2.67	2.675		V
Output Voltage Low	V_{OL}	$R_L = 100k\Omega$ to V+		1	10	mV
		$-40^\circ C \leq T_A \leq +125^\circ C$		2	10	mV
		$R_L = 10 k\Omega$ to V+		10	20	mV
		$-40^\circ C \leq T_A \leq +125^\circ C$		15	20	mV
Short Circuit Limit	I_{SC}	$-40^\circ C \leq T_A \leq +125^\circ C$	± 10	± 15		mA
Output Current	I_O	$-40^\circ C \leq T_A \leq +125^\circ C$		± 10		mA
		$-40^\circ C \leq T_A \leq +125^\circ C$		± 5		mA
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	$V_S = 2.7V$ to 5.5 V	120	130		dB
		$-40^\circ C \leq T_A \leq +125^\circ C$	115	130		dB
Supply Current/Amplifier	I_{SY}	$V_O = 0V$		1.1	1.4	mA
		$-40^\circ C \leq T_A \leq +125^\circ C$		1.3	1.6	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	$R_L = 10 k\Omega$		1		V/ μs
Overload Recovery Time				0.05		ms
Gain Bandwidth Product	GBP			2		MHz
NOISE PERFORMANCE						
Voltage Noise	$e_{n p-p}$	0.1 to 10 Hz		0.75		μV_{p-p}
Voltage Noise Density	e_n	$f = 1 kHz$		33		nV/ $\sqrt{Hz}$
Current Noise Density	i_n	$f=10 Hz$		5		fA/ $\sqrt{Hz}$

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ABSOLUTE MAXIMUM RATINGS

Supply Voltage	+6V
Input Voltage.....	GND to $V_s + 0.3V$
Differential Input Voltage ¹	$\pm 5.0V$
Output Short-Circuit Duration to Gnd.....	Indefinite
Storage Temperature Range	
RT, R Package	-65°C to +150°C
Operating Temperature Range	
AD8628	-40°C to +125°C
Junction Temperature Range	
RT, R Package	-65°C to +150°C
Lead Temperature Range (Soldering, 10 sec).....	+300°C

Package Type	θ_{JA} ²	θ_{JC}	Units
5-Pin SOT23 (RT)			°C/W
8-Pin SOIC (R)	158	43	°C/W

NOTES

¹ Differential input voltage is limited to ± 5.0 volts or the supply voltage, whichever is less.

² θ_{JA} is specified for the worst case conditions, i.e., θ_{JA} is specified for device in socket for P-DIP packages; θ_{JA} is specified for device soldered in circuit board for SOIC and TSSOP packages.

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
AD8628ART	-40°C to +125°C	5-Pin SOT23	RT-5
AD8628AR	-40°C to +125°C	8-Pin SOIC	SO-8