PRELIMINARY TECHNICAL DATA

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 µV/°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

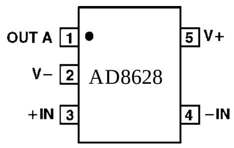
This new family of amplifiers has ultra-low offset, drift and bias current. The AD8628 is a wide bandwidth auto-zero amplifier featuring rail-to-rail input and output swings and low noise. Operation is fully specified from 2.7 to 5 volts single supply (±1.35V to ±2.5V dual supply).

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.

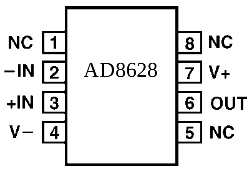
With an offset voltage of only 1µV, drift less than 0.005 µV/°C and noise of only 0.5uV P-P (0Hz to 10 Hz) the AD8628 is perfectly suited for applications where error sources cannot be tolerated. Position and pressure sensors, medical equipment, and strain gage amplifiers benefit greatly from nearly 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°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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ELECTRICAL SPECIFICATIONS (@ V_S=+5.0V, V_{CM} = +2.5V, V_O=+2.5V, T_A=+25°C unless otherwise specified.)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}			1	5	μV
		-40°C ≤ T_A ≤ +125°C			10	μV
Input Bias Current	I_B			30	100	pA
		-40°C ≤ T_A ≤ +125°C			1.5	nA
Input Offset Current	I_{OS}			50	200	pA
		-40°C ≤ T_A ≤ +125°C			250	pA
Input Voltage Range			0		5	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = 0V to 5V	120	140		dB
		-40°C ≤ T_A ≤ +125°C	115	130		dB
Large Signal Voltage Gain (Note 1)	A_{VO}	R_L = 10 kΩ, Vo=0.3 to 4.7V	125	145		dB
		-40°C ≤ T_A ≤ +125°C	120	135		dB
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	-40°C ≤ T_A ≤ +125°C		0.002	0.03	μV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	R_L = 100kΩ to Ground	4.99	4.996		V
		-40°C ≤ T_A ≤ +125°C	4.99	4.995		V
		R_L = 10kΩ to Ground	4.95	4.98		V
		-40°C ≤ T_A ≤ +125°C	4.95	4.97		V
Output Voltage Low	V_{OL}	R_L = 100kΩ to V+		1	10	mV
		-40°C ≤ T_A ≤ +125°C		2	10	mV
		R_L = 10 kΩ to V+		10	20	mV
		-40°C ≤ T_A ≤ +125°C		15	20	mV
Short Circuit Limit	I_{SC}		± 25	± 50		mA
		-40°C ≤ T_A ≤ +125°C		± 40		mA
Output Current	I_O			± 30		mA
		-40°C ≤ T_A ≤ +125°C		± 15		mA
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 2.7V to 5.5V	120	130		dB
		-40°C ≤ T_A ≤ +125°C	115	130		dB
Supply Current/Amplifier	I_{SY}	V_O = 0V		1.3	1.5	mA
		-40°C ≤ T_A ≤ +125°C		1.6	1.8	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L =10 kΩ		0.8		V/μs
Overload Recovery Time				0.05	0.2	ms
Gain Bandwidth Product	GBP			2.5		MHz
NOISE PERFORMANCE						
Voltage Noise	$e_{n\ p\text{-}p}$	0.1 to 10 Hz		0.5		$\mu V_{p\text{-}p}$
Voltage Noise	$e_{n\ p\text{-}p}$	0.1 to 1.0 Hz		0.16		$\mu V_{p\text{-}p}$
Voltage Noise Density	e_n	f = 1 kHz		22		nV/√Hz
Current Noise Density	i_n	f=10 Hz		5		fA/√Hz

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

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

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage AD8628	V_{OS}			1	5	µV
		-40°C ≤ T_A ≤ +125°C			10	µV
Input Bias Current	I_B			30	100	pA
		-40°C ≤ T_A ≤ +125°C		1.0	1.5	nA
Input Offset Current	I_{OS}			50	200	pA
		-40°C ≤ T_A ≤ +125°C			250	pA
Input Voltage Range			0		5	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = 0 to 2.9V	115	130		dB
		-40°C ≤ T_A ≤ +125°C	110	120		dB
Large Signal Voltage Gain	A_{VO}	R_L = 10 kΩ, Vo=0.3 to 4.7V	110	140		dB
		-40°C ≤ T_A ≤ +125°C	105	130		dB
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	-40°C ≤ T_A ≤ +125°C		0.002	0.03	µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	R_L = 100kΩ to Ground	2.68	2.695		V
		-40°C ≤ T_A ≤ +125°C	2.68	2.695		V
		R_L = 10kΩ to Ground	2.67	2.68		V
		-40°C ≤ T_A ≤ +125°C	2.67	2.675		V
Output Voltage Low	V_{OL}	R_L = 100kΩ to V+		1	10	mV
		-40°C ≤ T_A ≤ +125°C		2	10	mV
		R_L = 10 kΩ to V+		10	20	mV
		-40°C ≤ T_A ≤ +125°C		15	20	mV
Short Circuit Limit	I_{SC}		±10	± 15		mA
		-40°C ≤ T_A ≤ +125°C		± 10		mA
Output Current	I_O			± 10		mA
		-40°C ≤ T_A ≤ +125°C		± 5		mA
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 2.7V to 5.5 V	120	130		dB
		-40°C ≤ T_A ≤ +125°C	115	130		dB
Supply Current/Amplifier	I_{SY}	V_O = 0V		1.1	1.4	mA
		-40°C ≤ T_A ≤ +125°C		1.3	1.6	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L =10 kΩ		1		V/µs
Overload Recovery Time				0.05		ms
Gain Bandwidth Product	GBP			2		MHz
NOISE PERFORMANCE						
Voltage Noise	$e_{n\ p\text{-}p}$	0.1 to 10 Hz		0.75		$\mu V_{p\text{-}p}$
Voltage Noise Density	e_n	f = 1 kHz		33		nV/√Hz
Current Noise Density	i_n	f=10 Hz		5		fA/√Hz

AD8628

ABSOLUTE MAXIMUM RATINGS

Supply Voltage .... +6V
Input Voltage .... GND to Vs + 0.3V
Differential Input Voltage[1] .... ±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