16V Auto-Zero, Rail-to-Rail Output, Precision Amplifiers

Preliminary Technical Data

AD8638

FEATURES

Low Offset Voltage: 10 µV max.
Offset Drift: 0.08 µV/°C
Rail-to-Rail Output
16V Single or ±8V Dual Supply Operation
High Gain and CMRR: 140dB
High PSRR: 140 dB
Very Low Input Bias Current: 100 pA
Low Supply Current: 1.4 mA/amp

APPLICATIONS

Pressure and Position Sensors
Strain Gage Amplifiers
Medical Instrumentation
Thermocouple Amplifiers
Automotive Sensors
Precision References
Precision Current Sources

GENERAL DESCRIPTION

The AD8638 is a wide bandwidth auto-zero amplifiers featuring rail-to-rail output swing while operating from 5 V to 16 V single supply or +/–2.5 V to ±8V dual supplies.

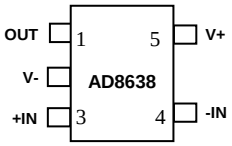
Using Analog Devices' new topology these zero-drift amplifiers combine low cost, with high accuracy and low noise. No external capacitors are required. In addition, the AD8638 family greatly reduces the digital switching noise often found in chopper-stabilized amplifiers.

With an offset voltage of 10 µV, offset drift less than 0.08 µV/°C and noise of only 1.5 µVp-p (0 Hz to 10 Hz), the AD8638 family is perfectly suited for applications where error sources must be minimized. Position and pressure sensors, thermocouple and thermopile detectors, and strain gage amplifiers benefit greatly from nearly zero drift over their operating temperature range.

The AD8638 family is specified for the extended industrial (-40° to +125°C) temperature range. The AD8638 is available in SOT-23 and SOIC.

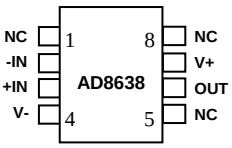
PIN CONFIGURATIONS

5- Lead SOT-23
(RJ-5 Suffix)



NC = NO CONNECT

8- Lead SOIC
(R-8 Suffix)



NC = NO CONNECT

Rev. PrA

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ELECTRICAL CHARACTERISTICS (@ V_S =16V, V_{CM} = Vs/2, T_A =+25°C unless otherwise specified.)

Parameter	Symbol	Conditions	A Grade			Units
			Min	Typ	Max	
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	25°C		3	10	µV
		-40°< T_A < +125°C			20	µV
Input Bias Current	I_B	25°C		20	100	pA
		-40°< T_A < +125°C			250	pA
Input Offset Current	I_{OS}			40	80	pA
		-40°< T_A < +125°C			150	pA
Input Voltage Range		-40°< T_A < +125°C	0		V_S - 2	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = -5V to +5V	120	140		dB
		-40°< T_A < +125°C	120	130		dB
Large Signal Voltage Gain (Note 1)	A_{VO}	R_L = 10 kΩ,V_O= -5 to +5V	130	130		dB
		-40°< T_A < +125°C	115	130		dB
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	-40°< T_A < +125°C		0.004	0.08	µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	R_L = 2 kΩ	15.8			V
		-40°C to +125°C		15.7		V
		R_L = 10KΩ	15.9	15.95		V
		-40°C to +125°C		15.95		V
Output Voltage Low	V_{OL}	R_L = 2 kΩ		100		mV
		-40°C to +125°C		170		mV
		R_L = 10KΩ		30	50	mV
		-40°C to +125°C		70		mV
Short Circuit Limit	I_{SC}			±45		mA
		-40°C to +125°C		40		mA
Output Current	I_{OUT}			±30		mA
		-40°C to +125°C				mA
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 5V to 16V	110	140		dB
		-40°C to +125°C				dB
Supply Current/Amplifier	I_{SY}	V_O = 0V		1.0	1.2	mA
		-40°< T_A < +125°C			1.4	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L =10 kΩ		2		V/µs
Overlay Recovery Time				50		µs
Gain Bandwidth Product	GBP			1.5		MHz
NOISE PERFORMANCE						
Voltage Noise	$e_{n\ p-p}$	f=0.1 to 10 Hz		1.5		μV_{p-p}
Voltage Noise Density	e_n	f=1kHz		59		nV/√Hz
Current Noise Density	i_n	f=10Hz		tbd		fA/√Hz

Note 1: Gain testing is highly dependent upon test bandwidth

ELECTRICAL CHARACTERISTICS (@ V_S =5V, V_{CM} = Vs/2, T_A =+25°C unless otherwise specified.)

Parameter	Symbol	Conditions	A Grade			Units
			Min	Typ	Max	
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}			3	10	µV
		-40°< T_A < +125°C			20	µV
Input Bias Current	I_B			15	40	pA
		-40°< T_A < +125°C			120	pA
Input Offset Current	I_{OS}			30	40	pA
		-40°< T_A < +125°C			60	pA
Input Voltage Range		-40°< T_A < +125°C	0		V_S - 2	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = -5V to +5V	120	135		dB
		-40°< T_A < +125°C	120	130		dB
Large Signal Voltage Gain (Note 1)	A_{VO}	R_L = 10 kΩ,V_O= -5 to +5V	130	140		dB
		-40°< T_A < +125°C	120	140		dB
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	-40°< T_A < +125°C		0.004	0.08	µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	R_L = 2 kΩ	4.9	4.95		V
		-40°C to +125°C		4.9		V
		R_L = 10 kΩ	4.95	4.99		V
		-40°C to +125°C		4.99		V
Output Voltage Low	V_{OL}	R_L = 2 kΩ		25		mV
		-40°C to +125°C		40		mV
		R_L = 10 kΩ		7	14	mV
		-40°C to +125°C		15		mV
Short Circuit Limit	I_{SC}			±20		mA
		-40°C to +125°C		15		mA
Output Current	I_{OUT}			±tbd		mA
		-40°C to +125°C				mA
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 5V to 16V	110	140		dB
		-40°C to +125°C				dB
Supply Current/Amplifier	I_{SY}	V_O = 0V		0.9	1	mA
		-40°< T_A < +125°C			1.2	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L =10 kΩ		2		V/µs
Overlay Recovery Time				50		µs
Gain Bandwidth Product	GBP			1.3		MHz
NOISE PERFORMANCE						
Voltage Noise	$e_{n\ p-p}$	f=0.1 to 10 Hz		1.5		µV_{p-p}
Voltage Noise Density	e_n	f=1kHz		59		nV/√Hz
Current Noise Density	i_n	f=10Hz		tbd		fA/√Hz

Note 1: Gain testing is highly dependent upon test bandwidth

ABSOLUTE MAXIMUM RATINGS[1]

Supply voltage ..... +16V
Input Voltage ..... ±Vs
Differential Input Voltage[1] ..... ±Vs
Output Short-Circuit Duration to Gnd ..... Indefinite
Storage Temperature Range
R, RM, RU Packages ..... -65°C to +150°C
Operating Temperature Range
AD8638 ..... -40°C to +125°C
Junction Temperature Range
R, RT Packages ..... -65°C to +150°C
Lead Temperature Range (Soldering, 60 Sec) ..... +300°C

Package Type	θ_{JA}[2]	θ_{JC}	Units
5-Lead SOT-23 (RT-5)	230	146	°C/W
8-Pin SOIC (R)	158	43	°C/W

NOTES

[1] Differential input voltage is limited to ±5V or the supply voltage whichever is less.

[2] θ_{JA} is specified for the worst case conditions, i.e., $\theta_{JA}$is specified for device soldered in circuit board for surface mount packages.

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
AD8638ARJZ	-40°C to +125°C	5-Lead SOT-23	RJ-5
AD8638ARZ	-40°C to +125°C	8-Lead SOIC_N	R-8

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