ANALOG DEVICES

Low Offset Single Supply Amplifiers

Preliminary Technical Data

AD8601/AD8602/AD8604

FEATURES
Low Offset Voltage
Single-Supply Operation: 2.7 V to 5.5 V
Low Supply Current: 700 μA/Amplifier
Wide Bandwidth: 8 MHz
Slew Rate: 5 V/μs
No Phase Reversal
Low Input Currents
Unity Gain Stable

APPLICATIONS
Barcode Scanners
ASIC Input or Output Amplifier
Multi Pole Filters
Medical Instrumentation
DAC Buffer
Audio

GENERAL DESCRIPTION

The AD8601, AD8602 and AD8604 are single, dual and quad rail-to-rail input and output amplifiers with very low offset voltage and wide bandwidths. These amplifiers use a new trimming technique that yields low offset voltages without laser trimming. All are guaranteed to operate from a 3 V single supply up to a 5 V supply.

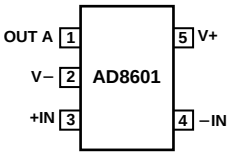
The combination of low offsets, very low input bias currents, and high speed make these amplifiers useful in a wide variety of applications. Filters, integrators and diode amplification all benefit from this combination of performance. Supply current is only 750 μA per amplifier at 5.0 V.

Applications include bar code scanners, multi-pole filters, and a wide range of other circuits. The ability to swing rail-to-rail at the inputs and outputs enables designers to buffer CMOS DACs, ASICs or other wide output swing devices in single-supply systems.

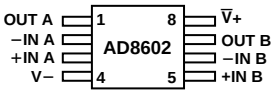
The AD8601, AD8602 and AD8604 are specified over the extended industrial (–40°C to +125°C) temperature range. The AD8601 is available in the SOT23-5 package. The AD8602 is available in SO-8 and 8-lead MSOP surface mount packages. The AD8604 is available in narrow SO-14 and 14-lead TSSOP surface mount packages. All TSSOP, MSOP and SOT versions are available in tape and reel only.

FUNCTIONAL BLOCK DIAGRAM

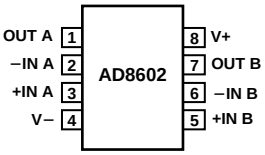
5-Lead SOT-23
(RT Suffix)



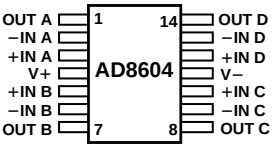
8-Lead MSOP
(RM Suffix)



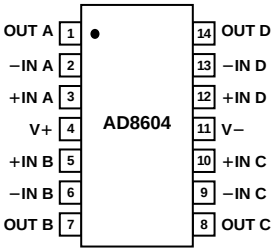
8-Lead SOIC
(R Suffix)



14-Lead TSSOP
(RU Suffix)



14-Lead SOIC
(R Suffix)



REV. PrB

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AD8601/AD8602/AD8604–SPECIFICATIONS

ELECTRICAL CHARACTERISTICS (V_S = 3 V, V_{CM} = 1.5 V, T_A = 25°C unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	0 V ≤ V_{CM} ≤ 3 V			750	µV
		–40°C ≤ T_A ≤ +125°C			1,100	µV
Input Bias Current	I_B			0.2	60	pA
		–40°C ≤ T_A ≤ +85°C			100	pA
		–40°C ≤ T_A ≤ +125°C			1,000	pA
Input Offset Current	I_{OS}			0.1	30	pA
		–40°C ≤ T_A ≤ +85°C			50	pA
		–40°C ≤ T_A ≤ +125°C			500	pA
Input Voltage Range			0		3	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = 0 V to 3 V	68	83		dB
Large Signal Voltage Gain	A_{VO}	R_L = 2 kΩ , V_O = 0.5 V to 2.5 V	30	100		V/mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$			2		µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L = 1.0 mA	2.92	2.95		V
		–40°C ≤ T_A ≤ +125°C	2.88			V
Output Voltage Low	V_{OL}	I_L = 1.0 mA		20	35	mV
		–40°C ≤ T_A ≤ +125°C			50	mV
Output Current	I_{OUT}			±30		mA
Closed Loop Output Impedance	Z_{OUT}	f = 1 MHz, A_V = 1		12		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 2.5 V to 5.5 V	67	80		dB
Supply Current/Amplifier	I_{SY}	V_O = 0 V		680	1,000	µA
		–40°C ≤ T_A ≤ +125°C			1,300	µA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 2 kΩ		5		V/µs
Settling Time	t_S	To 0.1%		<0.5		µs
Gain Bandwidth Product	GBP			8		MHz
Phase Margin	Φo			50		Degrees
NOISE PERFORMANCE						
Voltage Noise Density	e_n	f = 1 kHz		33		nV/√Hz
	e_n	f = 10 kHz		18		nV/√Hz
Current Noise Density	i_n			0.05		pA/√Hz

NOTE

Specifications subject to change without notice.

ELECTRICAL CHARACTERISTICS (V_S = 5.0 V, V_{CM} = 2.5 V, T_A = 25°C unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	0 V ≤ V_{CM} ≤ 5 V			500	µV
		–40°C ≤ T_A ≤ +125°C			1,300	µV
Input Bias Current	I_B			0.2	60	pA
		–40°C ≤ T_A ≤ +85°C			100	pA
		–40°C ≤ T_A ≤ +125°C			1,000	pA
Input Offset Current	I_{OS}			0.1	30	pA
		–40°C ≤ T_A ≤ +85°C			50	pA
		–40°C ≤ T_A ≤ +125°C			500	pA
Input Voltage Range			0		5	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = 0 V to 5 V	74	89		dB
Large Signal Voltage Gain	A_{VO}	R_L = 2 kΩ , V_O = 0.5 V to 4.5 V	30	70		V/mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	–40°C ≤ T_A ≤ +125°C		2		µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L = 1.0 mA	4.925	4.975		V
	V_{OH}	I_L = 10 mA	4.7	4.77		V
		–40°C ≤ T_A ≤ +125°C	4.60			V
Output Voltage Low	V_{OL}	I_L = 1.0 mA		15	30	mV
	V_{OL}	I_L = 10 mA		125	175	mV
		–40°C ≤ T_A ≤ +125°C			250	mV
Output Current	I_{OUT}			±50		mA
Closed Loop Output Impedance	Z_{OUT}	f = 1 MHz, A_V = 1		10		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 2.5 V to 5.5 V	67	80		dB
Supply Current/Amplifier	I_{SY}	V_O = 0 V		750	1,200	µA
		–40°C ≤ T_A ≤ +125°C			1,500	µA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 2 kΩ		6		V/µs
Full-Power Bandwidth	BW_P	1% Distortion		360		kHz
Settling Time	t_S	To 0.01%		<1.0		µs
Gain Bandwidth Product	GBP			8.4		MHz
Phase Margin	Φo			55		Degrees
NOISE PERFORMANCE						
Voltage Noise Density	e_n	f = 1 kHz		33		nV/√Hz
	e_n	f = 10 kHz		18		nV/√Hz
Current Noise Density	i_n			0.05		pA/√Hz

NOTE

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS[1]

Supply Voltage . . . . . +6 V
Input Voltage . . . . . GND to V_S
Differential Input Voltage . . . . . ±5.5 V
Storage Temperature Range
RU, R, RM, RT Packages . . . . . –65°C to +150°C
Operating Temperature Range
AD8601/AD8602/AD8604 . . . . . –40°C to +125°C
Junction Temperature Range
RU, R, RM, RT Packages . . . . . –65°C to +150°C
Lead Temperature Range (Soldering, 60 sec) . . . . . +300°C

NOTES
[1]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 listed in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Package Type	θ_{JA}[1]	θ_{JC}	Units
5-Lead SOT-23 (RT)	230	92	°C/W
8-Lead SOIC (R)	158	43	°C/W
8-Lead MSOP (RM)	190	44	°C/W
14-Lead SOIC (R)	120	36	°C/W
14-Lead TSSOP (RU)	180	35	°C/W

NOTE
[1]θ_{JA} is specified for worst case conditions, i.e., θ_{JA} is specified for device in socket for PDIP packages; θ_{JA} is specified for device soldered onto a circuit board for surface mount packages.

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
AD8601ART[1]	–40°C to +125°C	5-Lead SOT-23	RT-5
AD8602AR	–40°C to +125°C	8-Lead SOIC	SO-8
AD8602ARM[2]	–40°C to +125°C	8-Lead MSOP	RM-8
AD8604AR	–40°C to +125°C	14-Lead SOIC	SO-14
AD8604ARU[2]	–40°C to +125°C	14-Lead TSSOP	RU-14

[1]Available in 2,500 piece reels only.
[2]Available in 3,000 piece reels only.

CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the AD8601/AD8602/AD8604 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.