Quad Low Noise, Precision 16V CMOS Rail-to-Rail Operational Amplifiers

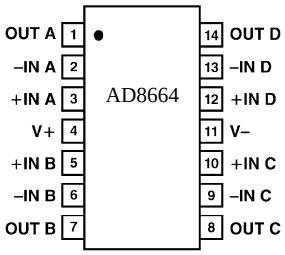
Preliminary Technical Data — AD8664

FEATURES
Low Offset Voltage: 100 μV max
Low Input Bias Currents 1pA Max
Single-Supply Operation: 5 to 16 Volts
Dual-Supply Operation: +/- 2.5 to +/-8 Volts
Low Noise: 10 nV/√Hz
Wide Bandwidth: 4 MHz
Unity Gain Stable

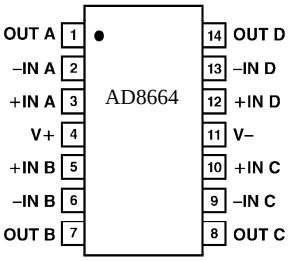
APPLICATIONS
Multi-pole Filters
Precision References
Physiological Measurements
Sensors
Medical Equipment
Consumer Audio
Photodiode amplification
Buffer / Level Shifting
ADC driver

PIN CONFIGURATIONS

14-Lead TSSOP (RU-14)



14-Lead SO (R-14)



GENERAL DESCRIPTION

The AD8664 is a quad rail-to-rail output single supply amplifiers that use Analog Devices' patented DigiTrim® trimming technique to achieve low offset voltage. The AD8664 family features an extended operating range with supply voltages up to 16 V. They also feature low input bias currents, wide signal bandwidth, and low input voltage and current noise.

The combination of low offsets, very low input bias currents, and wide supply range make these amplifiers useful in a wide variety of applications normally associated with much higher priced JFET amplifiers. Systems utilizing high impedance sensors, such as photo-diodes benefit from the combination of low input bias current, low noise, low offset and bandwidth. The wide operating voltage range matches today's high performance ADCs and DACs. Audio applications and medical monitoring equipment can take advantage of the high input impedance, low voltage and current noise, wide bandwidth and the lack of "popcorn" noise (found in many other low input bias current amplifiers).

The AD8664 is specified over the extended industrial (-40° to +125°C) temperature range. The AD8664, quad, is available in the 14-lead TSSOP and 14-lead SOIC package.

Single Version: AD8661

Dual Version: AD8662

REV. PrA

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ELECTRICAL CHARACTERISTICS (V_S=+5.0V, V_{CM} = V_S/2, T_A=+25°C unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	V_{SY} = 8V, V_{CM} = 3V			100	µV
		V_{CM} = -0.1V to 3.0V		30	200	µV
		-40°< T_A < +85°C				µV
		-40°< T_A < +125°C			1000	µV
Input Bias Current	I_B			0.3	1	pA
		-40°< T_A < +85°C			50	pA
		-40°< T_A < +125°C			300	pA
Input Offset Current	I_{OS}			0.2	0.5	pA
		-40°< T_A < +85°C			20	pA
		-40°< T_A < +125°C			75	pA
Input Voltage Range			-0.1		+3.0	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = -0.1V to 3.0V	85	100		dB
		-40°< T_A < +125°C	80	100		dB
Large Signal Voltage Gain	A_{VO}	R_L = 2 kΩ V_O= 0.5V to 4.5V	100	240		V/mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$			3	9	µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L = 1mA	4.85	4.93		V
		I_L = 10mA	4.80	4.85		V
		-40°C < T_A < +125°C	4.75			V
Output Voltage Low	V_{OL}	I_L = 1mA		50	100	mV
		-40°C < T_A < +125°C			120	mV
Short-Circuit Current	I_{SC}			±19		mA
Closed Loop Output Impedance	Z_{OUT}	f=1 MHz, A_V = 1		65		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 5 V to 16 V	95	110		dB
		-40°C < T_A < +125°C	95	115		dB
Supply Current/Amplifier	I_{SY}	V_O = 0V		1.15	1.4	mA
		-40°< T_A < +125°C			2.0	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L =2 kΩ		3		V/µs
Gain Bandwidth Product	GBP			4		MHz
Phase Margin	Øo			60		degrees
NOISE PERFORMANCE						
Peak-to-Peak Noise	e_n p-p	f=0.1Hz to 10 Hz		2.5		µV p-p
Voltage Noise Density	e_n	f=1kHz		12		nV/√Hz
Voltage Noise Density	e_n	f=10kHz		10		nV/√Hz
Current Noise Density	i_n	f=1kHz		0.1		pA/√Hz

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

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	V_{SY} = 8V, V_{CM} = 3V			100	μV
		V_{CM} = -0.1V to +14.0V		30	200	μV
		-40°< T_A < +85°C				μV
		-40°< T_A < +125°C			1000	μV
Input Bias Current	I_B			0.3	1	pA
		-40°< T_A < +85°C			50	pA
		-40°< T_A < +125°C			300	pA
Input Offset Current	I_{OS}			0.2	0.5	pA
		-40°< T_A < +85°C			20	pA
		-40°< T_A < +125°C			75	pA
Input Voltage Range			-0.1		+14	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = -0.1V to +14.0V	90	110		dB
		-40°< T_A < +125°C	90	110		
Large Signal Voltage Gain	A_{VO}	R_L=2 kΩ V_O= 0.5V to+15.5V	200	420		V/mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$			3	9	μV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L = 1mA	15.95	15.97		V
		I_L = 10mA	15.6	15.7		V
		-40°C < T_A < +125°C	15.5			V
Output Voltage Low	V_{OL}	I_L = 1mA		24	50	mV
		I_L = 10mA		210	350	mV
		-40°C < T_A < +125°C			450	mV
Short-Circuit Current	I_{SC}			±140		mA
Closed Loop Output Impedance	Z_{OUT}	f=1 MHz, A_V = 1		45		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 5V to 16V	95	110		dB
		-40°C < T_A < +125°C	95	115		dB
Supply Current/Amplifier	I_{SY}	V_O = 0V		1.25	1.55	mA
		-40°< T_A < +125°C			2.1	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L =2 kΩ		3.5		V/μs
Gain Bandwidth Product	GBP			4		MHz
Phase Margin	Øo			65		degrees
NOISE PERFORMANCE						
Peak-to-Peak Noise	e_n p-p	f=0.1Hz to 10 Hz		2.5		μV p-p
Voltage Noise Density	e_n	f=1kHz		12		nV/√Hz
Voltage Noise Density	e_n	f=10kHz		10		nV/√Hz
Current Noise Density	i_n	f=1kHz		0.1		pA/√Hz

ABSOLUTE MAXIMUM RATINGS[1]

Supply voltage ..... +18V
Input Voltage ..... Gnd to Vs
Differential Input Voltage ..... ±18V
Output Short-Circuit Duration to Gnd[2] ..... Observe Derating Curves
Storage Temperature Range
R, RU Package ..... -65°C to +150°C
Operating Temperature Range
AD8664 ..... -40°C to +125°C
Junction Temperature Range
R,RU Package ..... -65°C to +150°C
Lead Temperature Range (Soldering, 60 Sec) ..... +300°C

Package Type	θ_{JA}	θ_{JC}	Units
14-Pin SOIC (R)	120	36	°C/W
14-Pin TSSOP (RU)	180	35	°C/W

NOTES

[1] Absolute maximum ratings apply at 25°C, unless otherwise noted.

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

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option	Branding Information
AD8664ARZ	-40°C to +125°C	14-Pin SOIC	R-14	
AD8664ARUZ	-40°C to +125°C	14-Pin TSSOP	RU-14	

CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 1500 V readily accumulate on the human body and test equipment and can discharge without detection. Although this device 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.