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

Preliminary Technical Data

AD8669

FEATURES

Low offset voltage: 175 µV maximum @ V_{SY} = 5 V
Low supply current: 275 µA maximum per amplifier
Single-supply operation: 5 V to 16 V
Low noise: 23 nV/√Hz
Low input bias current: 300 fA
Unity-gain stable

APPLICATIONS

Sensors
Medical equipment
Consumer audio
Photodiode amplification
ADC drivers

PIN CONFIGURATIONS

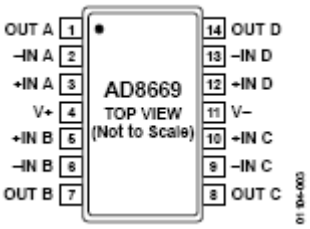

Figure 1. AD8669,14-Lead TSSOP (RU-14)

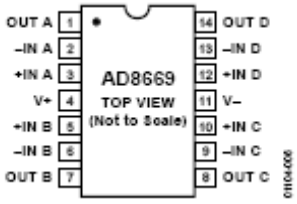

Figure 2. AD8669, 14-Lead SOIC (R-14)

GENERAL DESCRIPTION

The AD8669 is a rail-to-rail output, single-supply amplifier that uses the Analog Devices, Inc., patented DigiTrim® trimming technique to achieve low offset voltage. The AD8669 features an extended operating range, with supply voltages up to 16 V. It also features low input bias current, low input voltage, and low current noise.

The combination of low offset, very low input bias current, and a wide supply range makes these amplifiers useful in a wide variety of applications usually associated with higher priced JFET amplifiers. Systems using high impedance sensors, such as photodiodes, benefit from the combination of low input bias current, low noise, low offset, and wide bandwidth. The wide operating voltage range meets the demands of high performance ADCs and DACs. Audio applications and medical monitoring equipment can take advantage of the high input impedance, low voltage and current noise, and wide bandwidth.

The quad AD8669 is available in a narrow 14-lead SOIC package and 14-lead TSSOP. The AD8669 is specified over the extended industrial temperature range of −40°C to +125°C.

Rev. PrA

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REVISION HISTORY

9/07—Rev. 0 to Rev. A

Changes to Features 1
Changes to General Description 1
Changes to Table 1, Power Supply Section 3
Changes to Table 2 4

7/07—Revision 0: Initial Version

SPECIFICATIONS

AD8669 ELECTRICAL CHARACTERISTICS

V_{SY} = 5.0 V, V_{CM} = V_{SY}/2, T_A = 25°C, unless otherwise noted.

Table 1.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	V_{CM} = V_{SY}/2		30	175	µV
		−40°C < T_A < +85°C			375	µV
		−40°C < T_A < +125°C			450	µV
Input Bias Current	I_B			0.3		pA
		−40°C < T_A < +85°C			45	pA
		−40°C < T_A < +125°C			105	pA
Input Offset Current	I_{OS}			0.2	0.5	pA
		−40°C < T_A < +85°C			35	pA
		−40°C < T_A < +125°C			35	pA
Input Voltage Range			0.2		3.0	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = 0.2 V to 3.0 V	76	100		dB
		−40°C < T_A < +125°C	76	100		dB
Large Signal Voltage Gain	A_{VO}	R_L = 2 kΩ, V_{OUT} = 0.5 V to 4.5 V	106	114		dB
Offset Voltage Drift	TCV_{OS}	−40°C < T_A < +125°C		1.5	5	µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L = 1 mA	4.65	4.80		V
		−40°C < T_A < +125°C	4.60			V
Output Voltage Low	V_{OL}	I_L = 1 mA		150	200	mV
		−40°C < T_A < +125°C			250	mV
Short-Circuit Current	I_{SC}			±7		mA
Closed-Loop Output Impedance	Z_{OUT}	f = 1 MHz, A_V = 1		965		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_{SY} = 5 V to 16 V	95	105		dB
		−40°C < T_A < +125°C	95			dB
Supply Current	I_{SY}	V_{OUT} = V_{SY}/2		210	275	µA
		−40°C < T_A < +125°C			325	µA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 2 kΩ		0.26		V/µs
Gain Bandwidth Product	GBP	C_L = 20 pF		520		kHz
Phase Margin	Φ_O	C_L = 20 pF		60		Degrees
NOISE PERFORMANCE						
Peak-to-Peak Noise	e_N p-p	f = 0.1 Hz to 10 Hz		2.5		µV p-p
Voltage Noise Density	e_N	f = 1 kHz		23		nV/√Hz
		f = 10 kHz		21		nV/√Hz

V_{SY} = 16.0 V, V_{CM} = V_{SY}/2, T_A = 25°C, unless otherwise noted.

Table 2.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	$V_{CM} = V_{SY}/2$		40	300	µV
		−40°C < T_A < +85°C			500	µV
		−40°C < T_A < +125°C			500	µV
Input Bias Current	I_B			0.3		pA
		−40°C < T_A < +85°C		19	45	pA
		−40°C < T_A < +125°C		70	120	pA
Input Offset Current	I_{OS}			0.2	0.5	pA
		−40°C < T_A < +85°C		11	35	pA
		−40°C < T_A < +125°C		21	65	pA
Input Voltage Range			0.2		14.5	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = 0.2 V to 14.5 V	87	109		dB
		−40°C < T_A < +125°C	87	109		dB
Large Signal Voltage Gain	A_{VO}	R_L = 2 kΩ, V_{OUT} = 0.5 V to 15.5 V	106	111		dB
Offset Voltage Drift	TCV_{OS}	−40°C < T_A < +125°C		1.5	5	µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L = 1 mA	15.80	15.92		V
		I_L = 10 mA	14.80	15.12		V
		I_L = 10 mA, −40°C < T_A < +125°C	14.55			V
Output Voltage Low	V_{OL}	I_L = 1 mA		57	100	mV
		I_L = 10 mA		575	720	mV
		−40°C < T_A < +125°C			980	mV
Short-Circuit Current	I_{SC}			±42		mA
Closed-Loop Output Impedance	Z_{OUT}	f = 1 MHz, A_V = 1		720		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_{SY} = 5 V to 16 V	95	105		dB
		−40°C < T_A < +125°C	95			dB
Supply Current	I_{SY}	$V_{OUT} = V_{SY}/2$		230	285	µA
		−40°C < T_A < +125°C			355	µA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 2 kΩ		0.3		V/µs
Gain Bandwidth Product	GBP	C_L = 20 pF		540		kHz
Phase Margin	Φ_O	C_L = 20 pF		64		Degrees
NOISE PERFORMANCE						
Peak-to-Peak Noise	e_n p-p	f = 0.1 Hz to 10 Hz		2.5		µV p-p
Voltage Noise Density	e_n	f = 1 kHz		23		nV/√Hz
		f = 10 kHz		21		nV/√Hz

ABSOLUTE MAXIMUM RATINGS

Table 3.

Parameter	Rating
Supply Voltage	18 V
Input Voltage	−0.1 V to V_{SY}
Differential Input Voltage	18 V
Output Short-Circuit Duration to GND	Indefinite
Storage Temperature Range	−60°C to +150°C
Operating Temperature Range	
R-14, RU-14	−40°C to +125°C
Junction Temperature Range	−65°C to +150°C
Lead Temperature, Soldering (60 sec)	300°C

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 indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

THERMAL RESISTANCE

θ_{JA} is specified for the worst-case conditions, that is, a device soldered in a circuit board for surface-mount packages.

Table 4. Thermal Resistance

Package Type	θ_{JA}	θ_{JC}	Unit
14-Lead SOIC	TBD	TBD	°C/W
14-Lead TSSOP	TBD	TBD	°C/W

[1] Exposed pad soldered to application board.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.