16 V, 4 MHz Rail-to-Rail Output Amplifier

Preliminary Technical Data

AD8665

FEATURES

Lower price version of AD8661/AD8662/AD8664
Offset voltage: 2.5 mV max
Low input bias current: 1 pA max
Single-supply operation: 5 V to 16 V
Dual-supply operation: ±2.5 V to ±8 V
Low noise: 10 nV/√Hz
Wide bandwidth: 4 MHz
Rail-to-rail output
Unity gain stable
MSL 1 rating
Lead-free packaging

APPLICATIONS

Sensor amplification
Reference buffers
Medical equipment
Physiological measurements
Signal filters and conditioning
Consumer audio
Photodiode amplification
ADC driver
Level shifting circuits

PIN CONFIGURATIONS

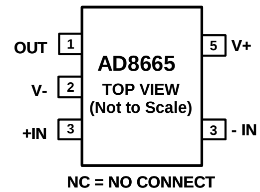

Figure 1. AD8665, 5-Lead SOT (RJ-5)

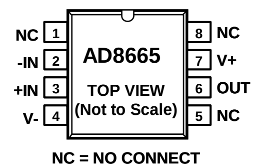

Figure 2. AD8665, SOIC (R-8)

GENERAL DESCRIPTION

The AD8665 is a rail-to-rail output single supply with low noise performance featuring 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. For lower offset voltage precision, choose the AD8661 (single).

The combination of offsets, very low input bias currents and wide supply range make these amplifiers useful in a wide variety of cost-sensitive 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, and 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 AD8665 is specified over the extended industrial (–40° to +125°C) temperature range.

Rev. PrA

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700 **www.analog.com**
Fax: 781.461.3113

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REVISION HISTORY

5/06—Rev 0: Initial Version

SPECIFICATIONS

V_{DD} = 5.0 V, V_{CM} = V_{DD}/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} = 2.5 V		0.7	2.5	mV
		V_{CM} = −0.1 V to +3.0 V			3.0	mV
		−40°C < T_A < +125°C			5.0	mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40°C < T_A < +125°C		3.0	10	µV/°C
Input Bias Current	I_B			0.2	1	pA
		−40°C < T_A < +125°C			550	pA
Input Offset Current	I_{OS}			0.1	0.5	pA
		−40°C < T_A < +125°C			70	pA
Input Voltage Range	V_{CM}		−0.1		+3.0	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = −0.1 V to +3.0 V	84	100		dB
		−40°C < T_A < +125°C	80			dB
Large-Signal Voltage Gain	A_{VO}	R_L = 2 kΩ, V_O = 0.5 V to 4.5 V	68	145		V/mV
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_{OUT} = 1 mA	4.88	4.93		V
		−40°C < T_A < +125°C	4.86			V
Output Voltage Low	V_{OL}	I_{OUT} = 1 mA		50	70	mV
		−40°C < T_A < +125°C			105	mV
Short-Circuit Output Current	I_{SC}			±19		mA
Closed-Loop Output Impedance	Z_{OUT}	At 1MHz, A_V = 1		50		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_{DD} = 5.0 V to 16 V	98	115		dB
		−40°C < T_A < +125°C	94			dB
Supply Current per Amplifier	I_{SY}			1.1	1.4	mA
		-40°C < T_A < +125°C			2.0	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 2 kΩ		3.5		V/µs
Gain Bandwidth Product	GBP			4		MHz
Phase Margin	Φ_M			70		Degrees
NOISE PERFORMANCE						
Peak-to-Peak Noise	e_n p-p	0.1 Hz to 10 Hz		2.4		µV p-p
Voltage Noise Density	e_n	f = 1 kHz		12		nV/√Hz
		f = 10 kHz		10		nV/√Hz
Channel Separation	CS	f = 10 kHz		−115		dB

V_{DD} = 16 V, V_{CM} = V_{DD}/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} = 8 V		0.6	2.5	mV
		V_{CM} = −0.1 V to +14.0 V			3.0	mV
		−40°C < T_A < +125°C			5.0	mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40°C < T_A < +125°C		3.0	10	μV/°C
Input Bias Current	I_B			0.2	1	pA
		−40°C < T_A < +125°C			550	pA
Input Offset Current	I_{OS}			0.1	0.5	pA
		−40°C < T_A < +125°C			70	pA
Input Voltage Range	V_{CM}		−0.1		+14.0	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = −0.1 V to +14.0 V	90	105		dB
		−40°C < T_A < +125°C	80			dB
Large-Signal Voltage Gain	A_{VO}	R_L = 2 kΩ, V_O = 0.5 V to 15.5 V	130	255		V/mV
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_{OUT} = 1 mA	15.94	15.96		V
		−40°C < T_A < +125°C	15.90			V
Output Voltage Low	V_{OL}	I_{OUT} = 1 mA		22	36	mV
		−40°C < T_A < +125°C			50	mV
Short-Circuit Output Current	I_{SC}			±140		mA
Closed-Loop Output Impedance	Z_{OUT}	At 1MHz, A_V = 1		50		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_{DD} = 5.0 V to 16 V	98	115		dB
		−40°C < T_A < +125°C	94			dB
Supply Current per Amplifier	I_{SY}			1.15	1.55	mA
		−40°C < T_A < +125°C			2.0	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 2 kΩ		3.5		V/μs
Gain Bandwidth Product	GBP			4		MHz
Phase Margin	Φ_M			73		Degrees
NOISE PERFORMANCE						
Peak-to-Peak Noise	e_n p-p	0.1 Hz to 10 Hz		2.5		μV p-p
Voltage Noise Density	e_n	f = 1 kHz		12		nV/√Hz
		f = 10 kHz		10		nV/√Hz
Channel Separation	CS	f = 10 kHz		−115		dB

ABSOLUTE MAXIMUM RATINGS

Table 3.

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

Table 4. Thermal Resistance

Package Type	θ_{JA}	θ_{JC}	Unit
8-Lead SOIC_N (R-8)	158	43	°C/W
5-Lead SOT (J-8)			°C/W

ESD 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 this product 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.

NOTES