16V, 180μA Low Power, Low Noise, Single Precision CMOS Rail-to-Rail Output Operational Amplifiers

Preliminary Technical Data

AD8663

FEATURES

Lower Power at High Voltage: 180 μA typ
Low offset voltage: 100 μV
Low input bias current: 300 fA Max
Low Voltage Noise:
21nV/√Hz @ 10kHz
23nV/√Hz @ 1kHz
Single-supply operation: 5V to 16V
Dual-supply operation: ±2.5V to ±8V
Output Drive 10mA
Unity Gain Stable

APPLICATIONS

Medical Equipment
Precision References
Buffer / Level Shifting
Portable Operated Systems
Sensors
Photodiode Amplification
ADC Drivers

GENERAL DESCRIPTION

The AD8663 is single rail-to-rail output single/dual supply amplifiers that use Analog Devices' patented DigiTrim® trimming technique to achieve low offset voltage, 300μV over the common mode range. The AD8663 family features an extended operating range with supply voltage up to 16V for low power operation with I_{SY} of < 325μA over the extended industrial temperature. These devices are designed for low noise at higher voltages, 21nV/√Hz at 10kHz and 23 nV/√Hz at 1 kHz. They also feature low input bias currents of 300fA and 10mA output drive.

The combination of low supply currents, low offsets, very low input bias currents, and wide supply range make these amplifiers useful in a wide variety of low power applications. Systems utilizing DC to low frequency measurements, or high impedance sensors, such as photo-diodes benefit from the combination of low input bias current, low noise, low offset and drive current. The wide operating voltage range matches today's high performance ADCs and DACs. Medical monitoring equipment can take advantage of the low voltage noise, high input impedance, low voltage and current noise.

The AD8663 is specified over the extended industrial (-40°C to +125°C) temperature range.

PIN CONFIGURATIONS

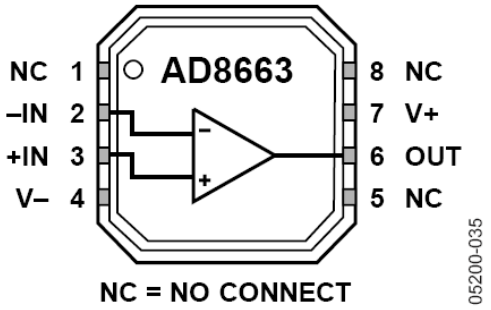

Figure 1. 8-Lead LFCSP_VD (CP-16-4 Suffix)

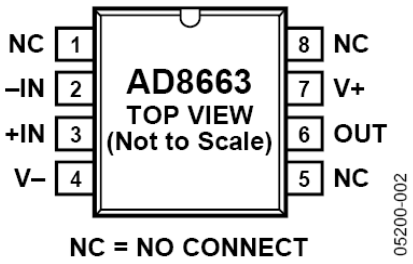

Figure 2. 8-Lead SOIC_N (R-8 Suffix)

Rev. PrA

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REVISION HISTORY

4/07—Revision 0: Initial Version

SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

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

Table 1.

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	V_{CM} = 2.5 V			100	µV
		−40°C < T_A < +125°C			350	µV
		V_{CM} = 0 V to 3.5 V		70	300	µV
		−40°C < T_A < +85°C		100	450	µV
		V_{CM} = 0.2 V to 3.5 V, −40°C < T_A < +125°C		100	450	µV
Input Bias Current	I_B			0.3		pA
		−40°C < T_A < +85°C			20	pA
		−40°C < T_A < +125°C			150	pA
Input Offset Current	I_{OS}			0.2		pA
		−40°C < T_A < +85°C			15	pA
		−40°C < T_A < +125°C			50	pA
Input Voltage Range	IVR	−40°C < T_A < +85°C	0		3.5	V
		−40°C < T_A < +125°C	0.2		3.5	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = 0 V to 3.5 V	80	90		dB
		V_{CM} = 0.2 V to 3.5 V, −40°C < T_A < +125°C	80	90		dB
Large Signal Voltage Gain	A_{VO}	R_L = 2 kΩ, V_O = 0.5 V to 4.5 V	106	115		dB
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40°C < T_A < +125°C		1.3	5	µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L = 1 mA	4.65	4.8		V
		−40°C < T_A < +125°C	4.6	4.7		V
Output Voltage Low	V_{OL}	I_L = 1 mA		150	200	mV
		−40°C < T_A < +125°C		200	250	mV
Short-Circuit Current	I_{SC}			±6		mA
Closed-Loop Output Impedance	Z_{OUT}	f = 100 kHz, A_V = 1		120		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 5 V to 16 V	95	105		dB
Supply Current/Amplifier	I_{SY}			180	275	µA
		−40°C < T_A < +125°C			325	µA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 2 kΩ		0.2		V/µs
Settling Time	t_S	To 0.1%, 0 V to 2 V step, A_V = 10		12		µs
Gain Bandwidth Product	GBP			600		kHz
Phase Margin	Φ_M			60		Degrees
NOISE PERFORMANCE						
Peak-to-Peak Noise	$e_{n\ p\text{-}p}$	f = 0.1 Hz to 10 Hz		3		µV p-p
Voltage Noise Density	e_n	f = 10 kHz		21		nV/√Hz
		f = 1 kHz		23		nV/√Hz
Current Noise Density	i_n	f = 1 kHz		0.05		pA/√Hz

V_S = 16 V, V_{CM} = V_S/2, T_A = 25°C unless otherwise noted.

Table 2.

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	V_{CM} = 8 V		40	300	µV
		−40°C < T_A < +125°C			350	µV
		V_{CM} = 0 V to 14.5 V		70	300	µV
		−40°C < T_A < +85°C			450	µV
		V_{CM} = 0.2 V to 14.5 V, −40°C < T_A < +125°C			450	µV
Input Bias Current	I_B			0.3		pA
		−40°C < T_A < +85°C			30	pA
		−40°C < T_A < +125°C			250	pA
Input Offset Current	I_{OS}			0.2		pA
		−40°C < T_A < +85°C			25	pA
		−40°C < T_A < +125°C			150	pA
Input Voltage Range	IVR	−40°C < T_A < +85°C	0		14.5	V
		−40°C < T_A < +125°C	0.2		14.5	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = 0 V to 14.5 V	90	100		dB
		V_{CM} = 0.2 V to 14.5 V, −40°C < T_A < +125°C	90	100		dB
Large Signal Voltage Gain	A_{VO}	R_L = 2 kΩ, V_O = 0.5 V to 15.5 V	112	124		dB
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$			1.2	5	µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L = 1 mA	15.8	15.9		V
		I_L = 10 mA	14.8	15.1		V
		I_L = 10 mA, −40°C < T_A < +125°C	14.65	14.8		V
Output Voltage Low	V_{OL}	I_L = 1 mA		80	100	mV
		I_L = 10 mA		600	720	mV
		I_L = 10 mA, −40°C < T_A < +125°C		800	900	mV
Short-Circuit Current	I_{SC}			±50		mA
Closed-Loop Output Impedance	Z_{OUT}	f = 100 kHz, A_V = 1		100		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 5 V to 16 V, −40°C < T_A < +125°C	95	105		dB
Supply Current/Amplifier	I_{SY}			230	285	µA
		−40°C < T_A < +125°C			325	µA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 2 kΩ		0.3		V/µs
Settling Time	t_S	To 0.1%, 0 V to 2 V step		12		µs
Gain Bandwidth Product	GBP			600		kHz
Phase Margin	Φ_M			60		Degrees
NOISE PERFORMANCE						
Peak-to-Peak Noise	$e_{n\,p-p}$	f = 0.1 Hz to 10 Hz		3		µV p-p
Voltage Noise Density	e_n	f = 1 kHz		23		nV/√Hz
		f = 10 kHz		21		nV/√Hz
Current Noise Density	i_n	f = 1 kHz		0.05		pA/√Hz

ABSOLUTE MAXIMUM RATINGS

Table 1.

Parameter	Rating
Supply Voltage	18V
Input Voltage	V_S supply
Differential Input Voltage	18V
Output Short-Circuit Duration to GND	Indefinite
Storage Temperature Range	−65°C to +150°C
Operating Temperature Range	−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 circuit board for surface-mount packages.

Table 2.

Package Type	θ_{JA}	θ_{JC}	Unit
8-Lead SOIC_N	121	43	°C/W
8-Lead LFCSP_VD	75	18	°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.

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
AD8663ACPZ-R2[1]	−40°C to +125°C	8-Lead Lead Frame Chip Scale Package [LFCSP_VD]	CP-8-2
AD8663ACPZ-R7[1]	−40°C to +125°C	8-Lead Lead Frame Chip Scale Package [LFCSP_VD]	CP-8-2
AD8663ACPZ-RL[1]	−40°C to +125°C	8-Lead Lead Frame Chip Scale Package [LFCSP_VD]	CP-8-2
AD8663ARZ[1]	−40°C to +125°C	8-Lead Standard Small Outline Package [SOIC_N]	R-8
AD8663ARZ-R7[1]	−40°C to +125°C	8-Lead Standard Small Outline Package [SOIC_N]	R-8
AD8663ARZ-RL[1]	−40°C to +125°C	8-Lead Standard Small Outline Package [SOIC_N]	R-8

[1] Z = Pb-free part.

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