Low Cost, Precision JFET Input Operational Amplifier in TSOT

Preliminary Technical Data

ADA4000-1

FEATURES

Very low offset voltage: 1 mV max
Bias current: 10 pA max
Small packaging, TSOT-23 lead-free
±5 V to ±15 V operation
High slew rate: 20 V/µs
Low voltage noise: 15 nV/√Hz
Unity gain stable
Wide bandwidth: 6 MHz

APPLICATIONS

Reference gain/buffers
Level shift/driving
Active filters
Power line monitoring/control
Current/voltage sense or monitoring
Data acquisition
Sample-and-hold circuits
Integrators

PIN CONFIGURATIONS

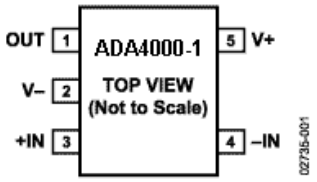

Figure 1. 5-Lead TSOT (UJ-5)

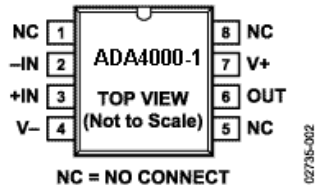

Figure 2. 8-Lead SOIC (R-8)

GENERAL DESCRIPTION

The AD4004 is a JFET input operational amplifier featuring precision, very low bias current, and low power in a tiny package at a very attractive price. Combining high input impedance, low input bias current, wide bandwidth, and fast slew rate, the AD4000 is an ideal amplifier for driving A/D inputs and buffering D/A converter outputs.

Additional applications for the AD4004 include electronic instruments; ATE amplification, buffering, and integrator circuits;

Instrumentation quality photodiode amplification; fast precision filters (including PLL filters), utility functions like reference buffering, level shifting, control I/O interface, power supply control and monitoring functions.

Rev. PrA

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REVISION HISTORY

10/05—Revision PrA: Preliminary Version

SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

V_S = ±5.0 V, V_{CM} = 0 V, T_A = +25°C, unless otherwise specified.

Table 1.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}			0.1	1.0	mV
Input Bias Current	I_B			5	10	pA
		−40°C ≤ T_A ≤ +125°C				pA
Input Offset Current	I_{OS}			5		pA
		−40°C ≤ T_A ≤ +125°C				pA
Input Voltage Range			−2.5		3.5	V
Common-Mode Rejection Ratio	CMRR	−1.5 V ≤ V_{CM} ≤ +3.5 V		76		dB
		−40°C ≤ T_A ≤ +125°C				dB
Open Loop Gain (Note 1)	A_{VO}	R_L = 2 kΩ, V_O = ±2.5 V		114		dB
		−40°C ≤ T_A ≤ +125°C				dB
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40°C ≤ T_A ≤ +125°C		10		µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	R_L = 2 kΩ to ground		4.0		V
		−40°C ≤T_A ≤ +125°C		3.7		V
Output Voltage Low	V_{OL}	R_L = 2 kΩ to ground		−3.35		V
		−40°C ≤ T_A ≤ +125°C		−3.7		V
Short Circuit Limit	I_{SC}			28		mA
		−40°C ≤ T_A ≤ +125°C				mA
Output Current	I_O			±10		mA
		−40°C ≤ T_A ≤ +125°C				mA
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = ±5.0 V to ±15.0 V		80		dB
		−40°C ≤T_A ≤ +125°C				dB
Supply Current/Amplifier	I_{SY}	V_O = 0 V		1.1		mA
		−40°C ≤ T_A ≤ +125°C				mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	Vi = 10 V, R_L = 2 kΩ, C_L = 100 pF		20		V/µs
Gain Bandwidth Product	GBP			6		MHz
NOISE PERFORMANCE						
Voltage Noise	$e_{n\ p\text{-}p}$	0.1 Hz to 10 Hz		1.2		µVp-p
Voltage Noise Density	en	f = 1 kHz		15		nV/√Hz
Current Noise Density	i_n	f = 1 kHz		0.01		pA/√Hz

V_S = ±15 V, V_{CM} = 0 V, T_A = +25°C, unless otherwise specified.

Table 2.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}			0.1	1.0	mV
Input Bias Current	I_B			5	10	pA
		−40°C ≤ T_A ≤ +125°C		5		pA
Input Offset Current	I_{OS}			5		pA
		−40°C ≤ T_A ≤ +125°C				pA
Input Voltage Range			−11		+15	V
Common-Mode Rejection Ratio	CMRR	−11 V ≤ V_{CM} ≤ +15 V		80		dB
		−40°C ≤ T_A ≤ +125°C				dB
Open Loop Gain	A_{VO}	R_L = 2kΩ, Vo= ±10V		114		dB
		−40°C ≤ T_A ≤ +125°C				dB
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40°C ≤ T_A ≤ +125°C		10		µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	R_L = 2 kΩ to ground		13.7		V
		−40°C ≤ T_A ≤ +125°C		13.5		V
Output Voltage Low	V_{OL}	R_L = 2 kΩ to ground		−13.3		V
		−40°C ≤ T_A ≤ +125°C		−13.5		V
Short Circuit Limit	I_{SC}			28		mA
		−40°C ≤ T_A ≤ +125°C				mA
Output Current	I_O			±10		mA
		−40°C ≤ T_A ≤ +125°C				mA
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = ±4.0 V to ±18.0 V		80		dB
		−40°C ≤ T_A ≤ +125°C				dB
Supply Current/Amplifier	I_{SY}			1.2		mA
		−40°C ≤ T_A ≤ +125°C				mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	Vi = 10 V, R_L = 2 kΩ, C_L = 100 pF		20		V/µs
Gain Bandwidth Product	GBP			6		MHz
NOISE PERFORMANCE						
Voltage Noise	$e_{n\ p\text{-}p}$	0.1 to 10 Hz		1.2		µVp-p
Voltage Noise Density	e_n	f = 1 kHz		15		nV/√Hz
Current Noise Density	i_n	f = 1 kHz		0.01		pA/√Hz

ABSOLUTE MAXIMUM RATINGS

Table 3.

Parameter	Rating
Supply Voltage	±18 V/+36 V
Input Voltage	±V supply
Differential Input Voltage[1]	±V supply
Output Short-Circuit Duration to Gnd	Indefinite
Storage Temperature Range	
UJZ, RZ Packages	−65°C to +150°C
Operating Temperature Range	
ADA4000-1	−40°C to +125°C
Junction Temperature Range	
UJZ, RZ Packages	−65°C to +150°C
Lead Temperature (Soldering, 10 sec)	+300°C

[1] Differential input voltage is limited to ±5.0 volts or the supply voltage, whichever is less.

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, for a device in socket for PDIP packages; a device soldered in a circuit board for SOIC and TSSOP packages.

Table 4. Thermal Resistance

Package Type	θ_{JA}	θ_{JC}	Unit
5-Pin TSOT (UJZ)			°C/W
8-Pin SOIC (RZ)	158	43	°C/W

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
ADA4000-1AUJZ [1]	–40°C to +125°C	5-Pin TSOT	UJZ-5
ADA4000-1ARZ [1]	–40°C to +125°C	8-Pin SOIC	RZ-8

[1] Z = Pb-free part.

NOTES

NOTES

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