Dual Low Power, Low Cost, Precision FET Op Amp

AD796

FEATURES

Low Noise
- 2.5 μV p–p max, 0.1 Hz to 10 Hz
- 10 nV/√Hz max at 10 kHz
- 14 fA p–p Current Noise 0.1 Hz to 10 Hz

High DC Accuracy
- 300 μV max Offset Voltage
- 3 μV/°C max Drift
- 2 pA max Input Bias Current
- 114 dB Open Loop Gain
- Low Power: 1.5 mA max per Amplifier

Good AC Performance
- 1 V/μs Slew Rate
- 2 MHz Unity Gain Bandwidth

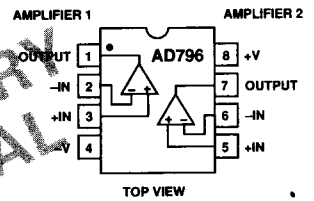
Available in 8-Pin Plastic Mini-DIP, Cerdip and Surface Mount (SOIC) Packages

APPLICATIONS

Low Noise Photodiode Preamps
CT Scanners
Precision I/V Converters

CONNECTION DIAGRAM

Plastic Mini-DIP (N) Package, Cerdip (Q) Package, and SOIC (R) Package



PRODUCT DESCRIPTION

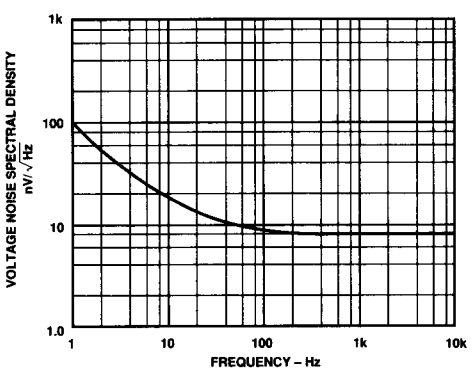
The AD796 is a low noise, precision, FET input, dual monolithic operational amplifier. Each amplifier offers both the low voltage noise and low offset drift of a bipolar input op amp and the very low bias current of a FET input device. The 10^{14} Ω common-mode impedance insures that input bias current is essentially independent of common-mode voltage variations.

The AD796 has both excellent dc performance and a guaranteed and tested maximum input voltage noise. Each amplifier features 2 pA maximum input bias current and 300 μV maximum offset voltage (AD796B) along with 1.5 mA max power supply current.

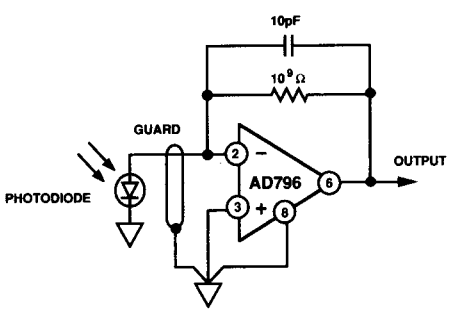
The AD796 features a guaranteed low input noise of 2.5 μV p–p (0.1 Hz to 10 Hz) and a 10 nV/√Hz max noise level at 10 kHz. The AD796 has a fully specified and tested input offset voltage drift of only 3 μV/°C max which is trimmed at the wafer level to keep device cost low.

The AD796 is the ideal choice for many high input impedance, low noise applications. It is available in three performance grades. The AD796A and AD796B are rated over the industrial temperature of −40°C to +85°C. The AD796S is rated over the military temperature range of −55°C to +125°C and is available processed to MIL-STD-883B.

The AD796 is available in 8-pin plastic mini-DIP, cerdip, and surface mount (SOIC).



Voltage Noise Spectral Density



The AD796 Used as a Sensitive Photodiode Preamplifier

This information applies to a product under development. Its characteristics and specifications are subject to change without notice. Analog Devices assumes no obligation regarding future manufacture unless otherwise agreed to in writing.

AD796—SPECIFICATIONS (@ +25°C and ±15 V dc, unless otherwise noted)

Parameter	Conditions	AD796A Min	AD796A Typ	AD796A Max	AD796B Min	AD796B Typ	AD796B Max	AD796S Min	AD796S Typ	AD796S Max	Units
INPUT OFFSET VOLTAGE[1]											
Initial Offset			100	500		50	300		100	500	μV
Offset	T_{MIN}–T_{MAX}		300	1000		100	400		500	1500	μV
vs. Temperature			3	12		2	3		4	10	μV/°C
vs. Supply		90	110		94	110		90	110		dB
vs. Supply (PSRR)	T_{MIN}–T_{MAX}		100		90	100		86	95		dB
INPUT BIAS CURRENT[2]											
Either Input	V_{CM} = 0 V		1.5	2.5		1.5	2		2	5	pA
Either Input @ T_{MAX} = 70°C	V_{CM} = 0 V		34/96			34/96			2050		pA
Either Input	V_{CM} = +10 V		1.5			1.5			1.5		pA
Offset Current	V_{CM} = 0 V		0.1	1.0		0.1	0.5		0.1	1.0	pA
Offset Current @ T_{MAX} = 70°C	V_{CM} = 0 V		2/6			2/6			100		pA
INPUT VOLTAGE NOISE	0.1 Hz to 10 Hz		1.0	3.3		1.0	2.5		1.0	3.3	μV p–p
	f = 10 Hz		20	50		20	40		20	50	nV/√Hz
	f = 100 Hz		10	30		10	20		10	30	nV/√Hz
	f = 1 kHz		7	15		7	10		7	15	nV/√Hz
	f = 10 kHz		8	10		8	10		8	10	nV/√Hz
INPUT CURRENT NOISE	f = 0.1 Hz to 10 Hz		14			14			18		fA p–p
	f = 0.1 kHz to 20 kHz		0.7			0.7			0.8		fA/√Hz
FREQUENCY RESPONSE											
Unity Gain, Small Signal	G = −1		2			2			2		MHz
Full Power Response	V_O = 20 V p–p										
	R_{LOAD} = 2 kΩ	12.8	16		12.8	16		12.8	16		kHz
Slew Rate, Unity Gain	V_{OUT} = 20 V p–p										
	R_{LOAD} = 2 kΩ		1			1			1		V/μs
SETTLING TIME[3]											
To 0.1%			11			11			11		μs
To 0.01%			12			12			12		μs
Overload Recovery[4]	50% Overdrive		5			5			5		μs
Total Harmonic	f = 1 kHz										
INPUT IMPEDANCE											
Differential	V_{DIFF} = ±1 V		10^{12}‖1			10^{12}‖1			10^{12}‖1		Ω‖pF
Common Mode			10^{14}‖2.2			10^{14}‖2.2			10^{14}‖2.2		Ω‖pF
INPUT VOLTAGE RANGE											
Differential[5]			±20			±20			±20		V
Common-Mode Voltage		±10	±11		±10	±11		±10	±11		V
Over Max Operating Range		±10			±10			±10			V
Common-Mode Rejection Ratio	V_{CM} = ±10 V	90	110		94	110		90	110		dB
	T_{MIN} to T_{MAX}		100		90	100		86	100		dB
OPEN-LOOP GAIN	V_O = ±10 V										
	R_{LOAD} ≥ 2 kΩ	100	110		100	110		114	130		dB
	T_{MIN}–T_{MAX}				100			110			dB
OUTPUT CHARACTERISTICS											
Voltage	R_{LOAD} ≥ 2 kΩ	±10	±11		±10	±11		±10	±11		V
	T_{MIN}–T_{MAX}										V
Current	V_{OUT} = ±10 V	±5	±10		±5	±10		±5	±10		mA
	Short Circuit		±15			±15			±15		mA
POWER SUPPLY											
Rated Performance			±15			±15			±15		V
Operating Range		±5		±18	±5		±18	±5		±18	V
Quiescent Current			2.5	3		2.5	3		2.5	3	mA

NOTES

[1]Input offset voltage specifications are guaranteed after 5 minutes of operation at T_A = +25°C.

[2]Bias current specifications are guaranteed maximum at either input after 5 minutes of operation at T_A = +25°C. For higher temperature, the current doubles every 10°C.

[3]Gain = −1, R_{LOAD} = 2 kΩ.

[4]Defined as the time required for the amplifier's output to return to normal operation after removal of a 50% overload from the amplifier input.

[5]Defined as the maximum continuous voltage between the inputs such that neither input exceeds ±10 V from ground.

All min and max specifications are guaranteed.

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS[1]

Supply Voltage . . . . . ±18 V
Internal Power Dissipation[2] (@ T_A = +25°C)
8-Pin Header Package . . . . . 500 mW
8-Pin Mini-DIP Package . . . . . 750 mW
8-Pin SOIC Package . . . . . 650 mW
Input Voltage . . . . . $\pm V_S$
Output Short Circuit Duration . . . . . Indefinite
Differential Input Voltage . . . . . $+V_S$ and $-V_S$
Storage Temperature Range (Q) . . . . . −65°C to +150°C
Storage Temperature Range (N) . . . . . −65°C to +125°C
Storage Temperature Range (R) . . . . . −65°C to +125°C
Operating Temperature Range
AD796A/B . . . . . −40°C to +85°C
AD796S . . . . . −55°C to +125°C
Lead Temperature Range (Soldering 60 secs) . . . . . +300°C

NOTES
[1]Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only, and 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.
[2]8-Pin Plastic Mini-DIP Package: θ_{JA} = 100°C/Watt
8-Pin Small Outline Package: θ_{JA} = 155°C/Watt
8-Pin Cerdip Package: θ_{JA} = 110°C/Watt

ORDERING GUIDE

Model	Temperature Range	Package Option*
AD796AN	−40°C to +85°C	N-8
AD796BN	−40°C to +85°C	N-8
AD796AR	−40°C to +85°C	R-8
AD796SQ-883B	−55°C to +125°C	Q-08

*N = Plastic mini-DIP, Q-8 = Cerdip, R = SOIC package. See outline information see Package Information section.