

Ultra-Low Offset Voltage Op Amp

FEATURES

Ten Times More Gain Than Other OP-07 Devices (3.0M min)

Ultra-Low Offset Voltage: 10µV

Ultra-Low Offset Voltage Drift: 0.2μV/°C

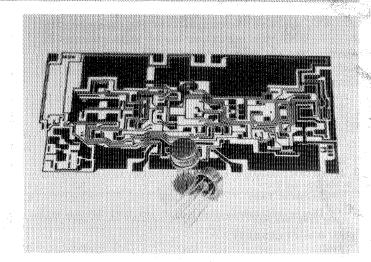
Ultra-Stable vs. Time: $0.2\mu V/month$ Ultra-Low Noise: $0.35\mu V$ p-p

No External Components Required

Monolithic Construction

High Common Mode Input Range: ±14.0V Wide Power Supply Voltage Range: ±3V to ±18V

Fits 725, 108A/308A Sockets



PRODUCT DESCRIPTION

The AD OP-07 is an improved version of the industry-standard OP-07 precision operational amplifier. A guaranteed minimum open-loop voltage gain of 3,000,000 (AD OP-07A) represents an order of magnitude improvement over older designs; this affords increased accuracy in high closed loop gain applications. Input offset voltages as low as $10\mu\text{V}$, bias currents of 0.7nA, internal compensation and device protection eliminate the need for external components and adjustments. An input offset voltage temperature coefficient of $0.2\mu\text{V}/^{\circ}\text{C}$ and long-term stability of $0.2\mu\text{V}/\text{month}$ eliminate recalibration or loss of initial accuracy.

A true differential operational amplifier, the AD OP-07 has a high common mode input voltage range ($\pm 14V$) high common mode rejection ratio (up to 126dB) and high differential input impedance ($50M\Omega$); these features combine to assure high accuracy in noninverting configurations. Such applications include instrumentation amplifiers, where the increased openloop gain maintains high linearity at high closed-loop gains.

The AD OP-07 is available in five performance grades. The AD OP-07E, AD OP-07C and AD OP-07D are specified for operation over the 0 to +70°C temperature range, while the AD OP-07A and AD OP-07 are specified for -55°C to +125°C operation. Processing to the requirements of MIL-STD-883, Class B, is available on the AD OP-07 and AD OP-07A. The devices are packaged in either TO-99 hermetically-sealed metal cans or plastic 8-pin mini DIPS.

PRODUCT HIGHLIGHTS

- 1. Increased open-loop voltage gain (3.0 million, min) results in better accuracy and linearity in high closed-loop gain applications.
- 2. Ultra-low offset voltage and offset voltage drift, combined with low input bias currents, allow the AD OP-07 to maintain high accuracy over the entire operating temperature range.
- 3. Internal frequency compensation, ultra-low input offset voltage and full device protection eliminate the need for additional components. This reduces circuit size and complexity and increases reliability.
- 4. High input impedances, large common mode input voltage range and high common mode rejection ratio make the AD OP-07 ideal for noninverting and differential instrumentation applications.
- 5. Monolithic construction along with advanced circuit design and processing techniques result in low cost.
- 6. The input offset voltage is trimmed at the wafer stage. Unmounted chips are available for hybrid circuit applications.

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Cables: ANALOG NORWOODMASS

SPECIFICATIONS $(T_A = +25^{\circ}C, V_S = \pm 15V, unless otherwise specified)$

MODEL		AD OP-07E			AD OP-07C			AD OP-07D		
PARAMETER	SYMBOL	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
OPEN LOOP GAIN	Avo	2,000	5,000	e in en	1,200	4,000		1,200	4,000	
or Erv Book Gran	• • •	1,800	4,500		1,000	4,000	an and organization	1,000	4,000	
2.01.71	and a second state of the second seco	300	1,000		300	1,000	2000 - 20	300	1,000	P m www.modernerger.com.ngcc
OUTPUT CHARACTERISTICS										
Maximum Output Swing	V _{OM}	±12.5	±13.0		±12.0	±13.0	:	±12.0	±13.0	
		±12.0	±12.8		±11.5	±12.8	1	±11.5	±12.8	
		±10.5	±12.0			±12.0				
C. I and Output Resistance	p.	±12.0	±12.6 60		±11.0	±12.6 60	i	±11.0	±12.6 60	
Open-Loop Output Resistance		Latinia And Pale continues		erent in a second	general and the second		Do mar every restrict a merch	ree administration		en · · · · · · · · · · · · · · · · · · ·
FREQUENCY RESPONSE Closed Loop Bandwidth	BW		0.6			0.6			0.6	
Slew Rate	SR		0.17			0.17	1		0.17	
INPUT ÓFFSET VOLTAGE	allialli il Alexandrasiani	Propries and Charles Colleges and Charles		manufol to the control of the control of		a position and analysis with		Ligariania III. L. 1277-11414	or committee and seem out that	representative of the state of the stat
Initial	Vos		30	75		60	150		60	150
••••	03	Silver of	45	130		85	250		85	250
Adjustment Range			±4			±4			±4	
Average Drift							(Note 3)			(Note 3
No External Trim	TCVOS	4	0.3	1.3		0.5	1.8		0.7	2.5
With External Trim	TCV_{OSN}	* *	0.3	1.3		0.4	1.6 (Note 3)		0.7	2.5 (Note 3
Long Term Stability	V _{OS} /Time		0.3	1.5	A LINUTE A	0.4	2.0		0.5	3.0
INPUT OFFSET CURRENT		į	WALESTANDERSON OF A CONTROL OF THE C	Charles Comment Could District	hammen	and the complete of the state of		Million and the second of the second	and the second s	, almost over the 12 strategic
Initial	I_{OS}		0.5	3.8		0.8	6.0		0.8	6.0
	03	1	0.9	5.3	- The second	1.6	8.0		1.6	8.0
Average Drift	TCIOS	and the second s	8 (Nat	35	1	12 (Note	, 50		12	, 50
- regionally organization as were recovery with the time and an extension of the contract of t	er-mention,	Littlemann och	(Note	e 3)	an evenency , and an in-	NOIS	E 3)	MOUNTAIN TO STATE OF	(Note	3)
INPUT BIAS CURRENT		8.0	+1.2	+4.0	# }	±1.0	+7.0		+3.0	410
Initial	IB		±1.2 ±1.5	±4.0 ±5.5	-	±1.8 ±2.2	±7.0 ±9.0		±2.0 ±3.0	±12 ±14
Average Drift	TCIB		13	35		18	50		18	50
ndin land till frem man av av av av 1952 – man man menne en a men 19. germens symmetre de di	Service and an or an order		(Note	<u>e 3)</u>	(Note 3)		(Note 3)		3)	
INPUT RESISTANCE	_									
Differential	R _{IN}	15	50		8	33	populari	7	31	
Common Mode	R _{IN} CM	t Henrich de des est est est Henrich	160	· · · · · · · · · · · · · · · · · · ·	reconstruction of the second s	120		erania e e e e e e	120	and the second of
INPUT NOISE										
Voltage	e _n p-p		0.35	0.6	Section and	0.38	0.65		0.38	0.65
Voltage Density	e _n		10.3 10.0	18.0		10.5	20.0		10.5	20.0
		1	9.6	13.0 11.0	And the second s	10.2 9.8	13.5 11.5		10.2 9.8	13.5 11.5
Current	i _n p-p		14	30		15	35		15	35
Current Density	i _n	•	0.32	0.80	eg:	0.35	0.90		0.35	0.90
,	***	i.	0.14	0.23		0.15	0.27		0.15	0.27
			0.12	0.17		0.13	0.18		0.13	0.18
INPUT VOLTAGE RANGE			a same - c - 6.5-iii a sama negye iii oo	Construent Marie Co	A POPULATION CONTRACTOR AND A CONTROL CONTROL CONTROL CONTRACTOR C	account of the second	***************************************	n it do northern in such .	and market and a second of the second	and the second second
Common Mode	CMVR	±13.0	±14.0		±13.0	±14.0		±13.0	±14.0	
		±13.0	±13.5		±13.0	±13.5		±13.0	±13.5	
Common Mode Rejection Ratio	CMRR	106	123		100	120		94	110	
рочите странти		103	123	and retrest to the latest and a second	97	120	A CONTRACTOR OF THE PROPERTY O	94	106	anton Postar open
POWER SUPPLY Current, Quiescent	Io.		3.0	4.0	E E	3.5	5.0		3.5	5.0
Power Consumption	I _Q P _D		90	120		3.5 105	5.0 150		3.3 105	5.0 150
Lower consumption	ע -		6.0	8.4	4	6.0	8.4		6.0	8.4
Rejection Ratio	PSRR	94	107		90	104	• •	90	104	• •
and the first of the community of the co		90	104	a processor event to the late of the con-	86	100	Committee of the Commit	86	100	er meen voor (haar en meen meen het he
OPERATING TEMPERATURE RANGE	T _{min} , T _{max}	0		+70	0		+70	0		+70
PACKAGE STYLE	IIIAA	100000	7	-, -: -,,,,					A major property of all majores of a	
"N" Package		1								
8-Pin Mini DIP			AD OP-07E	N	E E	AD OP-07C	N		AD OP-07DN	1
"H" Package						ŧ.				
TO-99		Γ.	AD OP-07E	Н		AD OP-07CI	H		AD OP-07DH	

NOTES:

¹The AD OP-07A and AD OP-07 are available processed to MIL-STD-883, Class B. Order AD OP-07AH-883B or AD OP-07H-883B.

²Input offset voltage measurements are performed by automated test equipment approximately 0.5 seconds after application of power. Additionally, AD OP-07A offset voltage is measured five minutes after power supply application at 25° C, -55° C and +125° C.

³Parameter is not 100% tested; 90% of units meet this specification.

⁴Long Term Input Offset Voltage Stability refers to the averaged trend line of Vos vs. Time over extended periods of time and is extrapolated from high temperature test data. Excluding the initial hour of operation, changes in Vos during the first 30 operating days are typically 2.5µV — Parameter is not 100% tested: 90% of units meet this specification.

Specifications subject to change without notice.

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AD OP-07AH (AD OP-07-AH-883B) ¹		AD OP-07H (AD OP-07-H-883B)1			OF COLUMN ASSESSMENT A		
MIN	TYP	MAX	MIN	TYP	MAX	TEST CONDITIONS	UNITS
3,000	5,000	SPECIAL SERVICE OF THE	2,000	5,000	**************************************	$R_L \geqslant 2k\Omega$, $V_O = \pm 10V$	37/37
2,000	4,000		1,500	4,000			V/mV
300	1,000		300	1,000		$R_L \ge 2k\Omega$, $V_0 = \pm 10V$, T_{min} to T_{max}	V/mV
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±12.5	±13.0		±12.5	±13.0		R _L ≥10kΩ	v
±12.0	±12.8		±12.0	±12.8		R _L ≥2kΩ	v
±10.5	±12.0		±10.5	±12.0		$R_L \geqslant 1k\Omega$	v
±12.0	±12.6		±12.0	±12.6		$R_L \ge 2k\Omega$, T_{min} to T_{max}	v
44Y 519601-0004-0004	60	. wagemen - menangan diliku sharara 1555 3865 ngga ng mangang 1556	ENTERPORT OF STATE OF STATE OF	60	Balances of the second of the	$V_O = 0$, $I_O = 0$	Ω
	0.4			0.4			
	0.6			0.6		A _{VCL} = +1.0	MHz
ndrocensors professional Mobile	0.17	CANNOT THE THE SECULOR STATE OF THE SECULOR OF THE	engerestimation and estimate on the section of the	0.17	15 666 e	$R_L\!\geqslant\!2k$	V/μs
	10	25		30	75	Note 2	μV
	25	60	1	60	200	Note 2, T _{min} to T _{max}	μV
	±4		V-000	±4	200	$R_{\rm P} = 20 k \Omega$	μν mV
	0.2	0.4		0.3		H 1 H 2 H 2 H 3 H 3 H 3 H 3 H 3 H 3 H 3 H 3	9
	0.2	0.6		0.3	1.3	T _{min} to T _{max}	μV/°C
	0.2	0.6		0.3	1.3	$R_P = 20k\Omega$, T_{min} to T_{max}	μV/°C
THE MEDIAN CONTRACTOR OF STREET	0.2	1.0	San Albania ta wangi ni sing 27 27 27 28 28 28 28 28 28 28 28 28 28 28 28 28	0.2	1.0	Note 4	μV/Mont
*	0.1	2.0	**************************************	0.4	2.0		
	0.3	2.0		0.4	2.8		nA
	0.8 5	4.0	To company	1.2	5.6	T _{min} to T _{max}	nA
0000g0000g0000g001100.1115.27 120415	J	25	and the second s	8	50	T _{min} to T _{max}	pA/°C
						The second secon	Andreas is sail, as the second
	±0.7	±2.0		±1.0	±3.0		nA
	±1.0	±4.0		±2.0	±6.0	T _{min} to T _{max}	nA
with American conceptions are a	8	25		13	50	T _{min} to T _{max}	pA/°C
10	00		20	40		WENTER TAXABLE	
30	80 200		20	60 200		-Seerey (III)	MΩ GΩ
ALAKA TANDAR MANAGAN MANAGAN TAN	on federal enterestation and make the second according	Magazine - A - A - Market Market Page and	Stude students and despite 1.12 (1986) Stage and despite	TORROW MAN AND A CONTROL OF THE SAME AND A SAME SAME AND A CONTROL OF THE SAME SAME AND A CONTROL OF THE SAME SAME AND A CONTROL OF THE SAME SAME SAME AND A CONTROL OF THE SAME SAME SAME SAME SAME SAME SAME SAM	Total and and a second	Septembers of the consumers on the consumers of the consu	The control of the co
	0.35	0.6		0.35	0.6	0.1Hz to 10Hz, Note 3	μV p-p
	10.3	18.0		10.3	18.0	$f_O = 10Hz$, Note 3	nV/√Hz
	10.0	13.0	į.	10.0	13.0	f _O = 100Hz, Note 3	nV/√Hz
	9.6	11.0		9.6	11.0	$f_O = 1$ kHz, Note 3	nV/√Hz
	14	30		14	30	0.1Hz to 10Hz, Note 3	pA p-p
	0.32	0.80		0.32	0.80	$f_O = 10$ Hz, Note 3	pA/√Hz
	0.14	0.23	A Company of the Comp	0.14	0.23	f _O = 100Hz, Note 3	pA/√Hz
con make accommoderate participal	0.12	0.17	energiales en encentrores de l'appears en	0.12	0.17	fo = 1kHz, Note 3	pA/√Hz
±13.0	±14.0		±13.0	±14.0		a representation	v
±13.0	±13.5		±13.0	±13.5		T _{min} to T _{max}	V
110	126		110	126		$V_{CM} = \pm CMVR$	dB
106	123		106	123		$V_{CM} = \pm CMVR$, T_{min} to T_{max}	dB
e well-teelli 'a ineer	r 1900 000 IIIIIAAIII waxon sann madnifar 160 -	Dollinativescommunication of an analysis and an analysis of the second o	Clariford St. v. (ET 0002" Cl2) - Little crease con distribution of the control o	970 (188) - ngurun ara galgari (18 a 175) - 1859 aran - Luaria (1871 - 1	Are compacted in 1875 of the concentral halls.	Management (197) didless to the extension of the control of the co	reproduces amaging a production
	3.0	4.0		3.0	4.0	$V_S = \pm 15V$	mA
	90	120		90	120	$V_S = \pm 15V$	mW
100	6.0	8.4	100	6.0	8.4	$V_S = \pm 3V$	mW
100 94	110 106		100 94	110 106		$V_S = \pm 3V \text{ to } \pm 18V$ $V_S = \pm 3V \text{ to } \pm 18V, T_{min} \text{ to } T_{max}$	dB dB
26-30 Scottoner consister 24-25	K KERAL AND	er menn 10 Til. San sen moon is summanised	bere to a common contract of the design	moreover mercentrelierer m	took - 100		4
-55	200 4 - a-Ab moontholistististist (1) b-A	+125	-55		+125	Y S S S S S S S S S S S S S S S S S S S	°C
						THE CONTRACT OF THE CONTRACT O	1
	_					de Calaire e Cal	1
	. =					organista de la constanta de l	
AD OP-07AH		AD OP-07H			garage and the second of the s	Å	

ABSOLUTE MAXIMUM RATINGS

Supply Voltage±22V	Storage Temperature Range65°C to +150°C
Internal Power Dissipation (Note 1) 500mW	Operating Temperature Range
Differential Input Voltage	OP-07A, OP-0755°C to +125°C
Input Voltage (Note 2)	OP-07E, OP-07C, OP-07D 0 to $+70^{\circ}$ C
Output Short Circuit Duration Indefinite	Lead Temperature Range (Soldering, 60sec) 300°C
NOTES:	

Note 1: Maximum package power dissipation vs. ambient temperature.

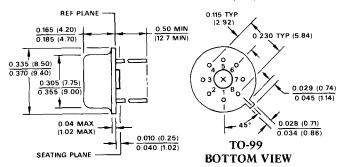
Maximum Ambient Derate Above Maximum Package Type Temperature for Rating Ambient Temperature

TO-99 (H) 80°C 7.1mW/°C

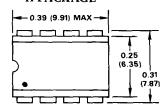
Note 2: For supply voltages less than ±22 V, the absolute maximum input voltage is equal to the supply voltage.

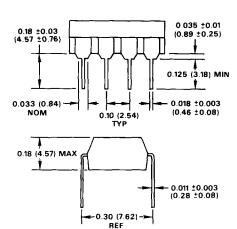
OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).

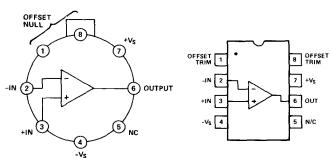


H-PACKAGE





N-PACKAGE PIN CONFIGURATION TOP VIEW

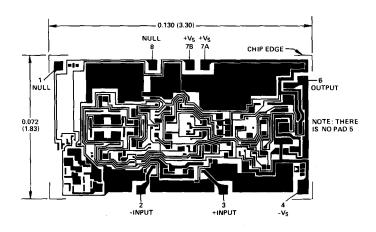


H-PACKAGE

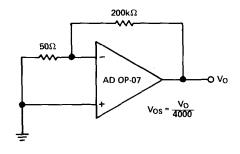
N-PACKAGE

CHIP DIMENSIONS AND BONDING DIAGRAM

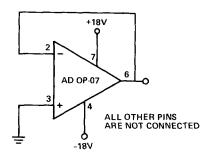
Dimensions shown in inches and (mm).



The AD OP-07 is available in wafer-trimmed chip form for precision hybrids. Consult the factory directly for details.



Offset Voltage Test Circuit



Burn-In Circuit

The AD OP-07 may be directly substituted for other OP-07's as well as 725, 108/208/308, 108A/208A/308A, 714, OP-05 or LM11 devices, with or without removal of external frequency compensation or offset nulling components. If used to replace 741 devices, offset nulling components must be re-

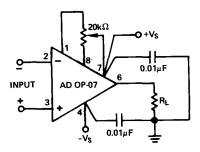


Figure 1. Optional Offset Nulling Circuit and Power Supply Bypassing

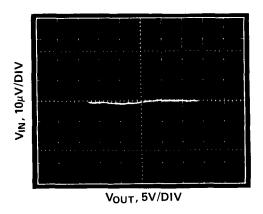
moved (or referenced to +V_S). Input offset voltage of the AD OP-07 is very low, but if additional nulling is required, the circuit shown in Figure 1 is recommended.

The AD OP-07 provides stable operation with load capacitances up to 500pF and $\pm 10V$ swings; larger capacitances should be decoupled with 50Ω resistor.

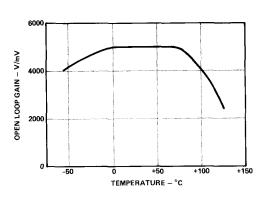
Stray thermoelectric voltages generated by dissimilar metals (thermocouples) at the contacts to the input terminals can prevent realization of the drift performance indicated. Best operation will be obtained when both input contacts are maintained at the same temperature, preferably close to the temperature of the device's package.

Although the AD OP-07 features high power supply rejection, the effects of noise on the power supplies may be minimized by bypassing the power supplies as close to pins 4 and 7 of the AD OP-07 as possible, to load ground with a good-quality $0.01\mu\text{F}$ ceramic capacitor as shown in Figure 1.

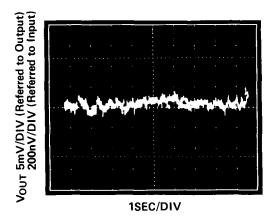
Performance Curves (typical @ $T_A = +25^{\circ}C$, $V_S = \pm 15V$, AD OP-07 Grade Device unless otherwise noted)



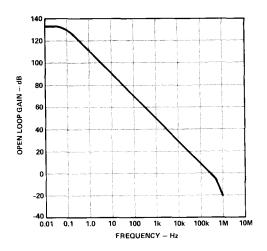
AD OP-07 Open Loop Gain Curve



Open Loop Gain vs. Temperature

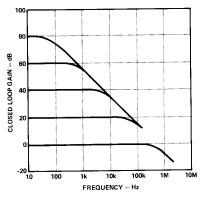


AD OP-07 Low Frequency Noise (See Test Circuit, on the Previous Page)

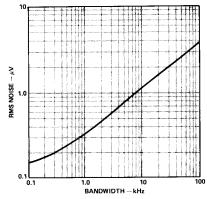


Open Loop Frequency Response

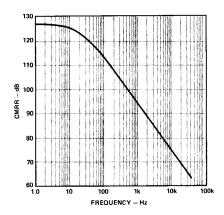
Typical Performance Curves



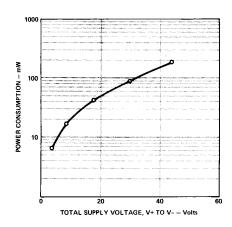
Closed Loop Response for Various Gain Configurations



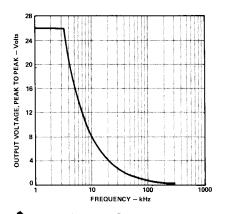
Input Wideband Noise vs. Bandwidth (0.1kHz to Frequency Indicated)



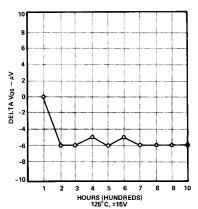
CMRR vs. Frequency



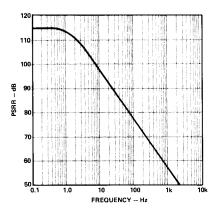
Power Consumption vs. Power Supply



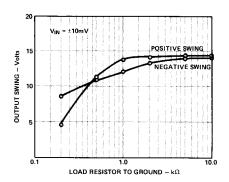
Maximum Undistorted Output vs. Frequency



Offset Voltage vs. Time



PSRR vs. Frequency



Output Voltage vs. Load Resistance