ANALOG DEVICES

Low Cost, High Accuracy IC Op Amps

AD741 Series

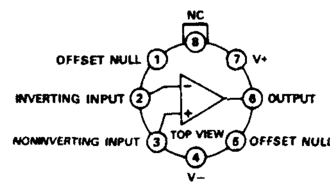
FEATURES
Precision Input Characteristics
- Low V_{OS}: 0.5 mV max (L)
- Low V_{OS} Drift: 5 μV/°C max (L)
- Low I_b: 50 nA max (L)
- Low I_{OS}: 5 nA max (L)
- High CMRR: 90 dB min (K, L)

High Output Capability
- A_{OL} = 25,000 min, 1 kΩ Load (J, S) T_{min} to T_{max}
- V_O = ±10 V min, 1 kΩ Load (J, S)

Chips and MIL-STD-883B Parts Available

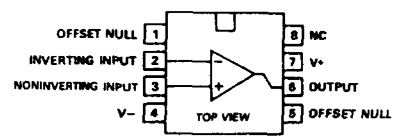
AD741 SERIES FUNCTIONAL BLOCK DIAGRAMS

TO-99 (H) Package



NOTE: PIN 4 CONNECTED TO CASE

Mini-DIP (N) Package



GENERAL DESCRIPTION

The Analog Devices AD741 Series are high performance monolithic operational amplifiers. All the devices feature full short circuit protection and internal compensation.

The Analog Devices AD741J, AD741K, AD741L, and AD741S are specially tested and selected versions of the standard AD741 operational amplifier. Improved processing and additional electrical testing guarantee the user precision performance at a very-low cost. The AD741J, K and L substantially increase overall accuracy over the standard AD741C by providing maximum limits on offset voltage drift and significantly reducing the errors due to offset voltage, bias current, offset current, voltage gain, power supply rejection, and common-mode rejection. For example, the AD741L features maximum offset voltage drift of 5 μV/°C, offset voltage of 0.5 mV max, offset current of 5 nA max, bias current of 50 nA max, and a CMRR of 90 dB min. The AD741S offers guaranteed performance over the extended temperature range of −55°C to +125°C, with max offset voltage drift of 15 μV/°C, max offset voltage of 4 mV, max offset current of 25 nA, and a minimum CMRR of 80 dB.

HIGH OUTPUT CAPABILITY

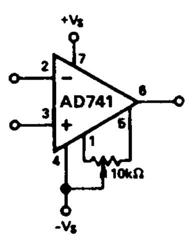
Both the AD741J and AD741S offer the user the additional advantages of high guaranteed output current and gain at low values of load impedance. The AD741J guarantees a minimum gain of 25,000 swinging ±10 V into a 1 kΩ load from 0 to +70°C. The AD741S guarantees a minimum gain of 25,000 swinging ±10 V into a 1 kΩ load from −55°C to +125°C.

All devices feature full short circuit protection, high gain, high common-mode range, and internal compensation. The AD741J, K and L are specified for operation from 0 to +70°C, and are available in both the TO-99 and mini-DIP packages. The AD741S is specified for operation from −55°C to +125°C, and is available in the TO-99 package.

SPECIFICATIONS (typical @ +25°C and ±15 V dc, unless otherwise specified)

Model	AD741C Min	AD741C Typ	AD741C Max	AD741 Min	AD741 Typ	AD741 Max	AD741J Min	AD741J Typ	AD741J Max	Units
OPEN-LOOP GAIN										
R_L = 1 kΩ, V_O = ±10 V							**50,000**	200,000		V/V
R_L = 2 kΩ, V_O = ±10 V	**20,000**	200,000		**50,000**	200,000					V/V
T_A = min to max R_L = 2 kΩ	**15,000**			**25,000**			**25,000**			V/V
OUTPUT CHARACTERISTICS										
Voltage @ R_L = 1 kΩ, T_A = min to max							**±10**	±13		V
Voltage @ R_L = 2 kΩ, T_A = min to max	**±10**	±13		**±10**	±13					V
Short Circuit Current		25			25			25		mA
FREQUENCY RESPONSE										
Unity Gain, Small Signal		1			1			1		MHz
Full Power Response		10			10			10		kHz
Slew Rate		0.5			0.5			0.5		V/μs
Transient Response (Unity Gain)										
Rise Time C_L ≤ 10 V p–p		0.3			0.3			0.3		μs
Overshoot		5.0			5.0			5.0		%
INPUT OFFSET VOLTAGE										
Initial, R_S ≤ 10 kΩ, Adjust to Zero		1.0	**6.0**		1.0	**5.0**		1.0	**3.0**	mV
T_A = min to max		1.0	**7.5**		1.0	**6.0**			**4.0**	mV
Average vs. Temperature (Untrimmed)									20	μV/°C
vs. Supply, T_A = min to max								30	100	μV/V
INPUT OFFSET CURRENT										
Initial		20	**200**		20	**200**		5	**50**	nA
T_A = min to max		40	**300**		85	500			**100**	nA
Average vs. Temperature								0.1		nA/°C
INPUT BIAS CURRENT										
Initial		80	**500**		80	**500**		40	**200**	nA
T_A = min to max		120	**800**		300	1,500			**400**	nA
Average vs. Temperature								0.6		nA/°C
INPUT IMPEDANCE DIFFERENTIAL	0.3	2.0		0.3	2.0			1.0		MΩ
INPUT VOLTAGE RANGE[1]										
Differential, max Safe									±30	V
Common-Mode, max Safe	±12	±13		±12	±13			±15		V
Common-Mode Rejection, R_S = ≤ 10 kΩ, T_A = min to max, V_{IN} = ±12 V	**70**	90		**70**	90		**80**	90		dB
POWER SUPPLY										
Rated Performance		±15			±15			±15		V
Operating							±5		±18	V
Power Supply Rejection Ratio		30	**150**		30	**150**				μV/V
Quiescent Current		1.7	**2.8**		1.7	**2.8**		2.2	**3.3**	mA
Power Consumption		50	85		50	85		50	85	mW
T_A = min					60	100				mW
T_A = max					45	75				mW
TEMPERATURE RANGE										
Operating Rated Performance	0		+70	−55		+125	0		+70	°C
Storage	−65		+150	−65		+150	−65		+150	°C

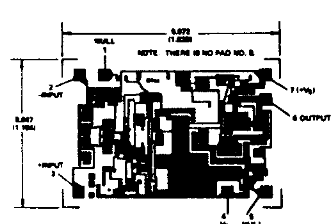
NOTES
[1]For supply voltages less than ±15 V, the absolute maximum input voltage is equal to the supply voltage.
Specifications subject to change without notice.
All min and max specifications are guaranteed. Specifications shown in **boldface** are tested on all production units at final electrical test. Results from those tests are used to calculate outgoing quality levels.



Standard Nulling Offset Circuit

METALIZATION PHOTOGRAPH

All versions of the AD741 are available in chip form.
Contact factory for latest dimensions.
Dimensions shown in inches and (mm).



PAD NUMBERS CORRESPOND TO PIN NUMBERS FOR THE TO-99 8 PIN METAL PACKAGE.

2

Model	AD741K Min	AD741K Typ	AD741K Max	AD741L Min	AD741L Typ	AD741L Max	AD741S Min	AD741S Typ	AD741S Max	Units
OPEN-LOOP GAIN										
R_L = 1 kΩ, V_O = ±10 V							50,000	200,000		V/V
R_L = 2 kΩ, V_O = ±10 V	50,000	200,000		50,000	200,000					V/V
T_A = min to max R_L = 2 kΩ	25,000			25,000			25,000			V/V
OUTPUT CHARACTERISTICS										
Voltage @ R_L = 1 kΩ, T_A = min to max										
Voltage @ R_L = 2 kΩ, T_A = min to max	±10	±13		±10	±13		±10	±13		V
Short Circuit Current		25			25			25		mA
FREQUENCY RESPONSE										
Unity Gain, Small Signal		1			1			1		MHz
Full Power Response		10			10			10		kHz
Slew Rate		0.5			0.5			0.5		V/µs
Transient Response (Unity Gain)										
Rise Time		0.3			0.3			0.3		µs
Overshoot		5.0			5.0			5.0		%
INPUT OFFSET VOLTAGE										
Initial, R_S ≤ 10 kΩ, Adjust to Zero		0.5	2.0		0.2	0.5		1.0	2	mV
T_A = min to max			3.0			1.0			4	mV
Average vs. Temperature (Untrimmed)		6.0	15.0		2.0	5.0		6.0	15.0	µV/°C
vs. Supply, T_A = min to max		5	15.0		5	15.0		30	100	µV/V
INPUT OFFSET CURRENT										
Initial		2	10		2	5		2	10	nA
T_A = min to max			15			10			25	nA
Average vs. Temperature		0.02	0.02		0.02	0.1		0.1	0.25	nA/°C
INPUT BIAS CURRENT										
Initial		30	75		30	50		30	75	nA
T_A = min to max			120			100			250	nA
Average vs. Temperature		0.6	1.5		0.6	1.0		0.6	2.0	nA/°C
INPUT IMPEDANCE DIFFERENTIAL		2			2			2		MΩ
INPUT VOLTAGE RANGE[1]										
Differential, max Safe		±30			±30			±30		V
Common-Mode, max Safe		±15			±15			±15		V
Common-Mode Rejection, R_S = ≤ 10 kΩ, T_A = min to max, V_{IN} = ±12 V	90	100		90	100		90	100		dB
POWER SUPPLY										
Rated Performance		±15			±15			±15		V
Operating	±5		±22	±5		±22	±5		±22	V
Power Supply Rejection Ratio		20			20			20		µV/V
Quiescent Current		1.7	2.8		1.7	2.8		2.0	2.8	mA
Power Consumption		50	85		50	85		50	85	mW
T_A = min								60	100	mW
T_A = max								75	115	mW
TEMPERATURE RANGE										
Operating Rated Performance	0		+70	0		+70	−55		+125	°C
Storage	−65		+150	−65		+150	−65		+150	°C

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings	AD741, J, K, L, S	AD741C
Supply Voltage	±22 V	±18 V
Internal Power Dissipation	500 mW[1]	500 mW
Differential Input Voltage	±30 V	±30 V
Input Voltage	±15 V	±15 V
Storage Temperature Range	−65°C to +150°C	−65°C to +150°C
Lead Temperature (Soldering, 60 sec)	+300°C	+300°C
Output Short Circuit Duration	Indefinite[2]	Indefinite

NOTES
[1]Rating applies for case temperature to +125°C. Derate TO-99 linearity at 6.5 mW/°C for ambient temperatures above +70°C.
[2]Rating applies for shorts to ground or either supply at case temperatures to +125°C or ambient temperatures to +75°C.

ORDERING GUIDE[1]

Model	Temperature Range	Package Options[2]	Initial Off Set Voltage
AD741CN	0 to +70°C	Mini-DIP (N-8)	6.0 mV
AD741CH	0 to +70°C	TO-99 (H-08A)	6.0 mV
AD741JN	0 to +70°C	Mini-DIP (N-8)	3.0 mV
AD741JH	0 to +70°C	TO-99 (H-08A)	3.0 mV
AD741KN	0 to +70°C	Mini-DIP (N-8)	2.0 mV
AD741KH	0 to +70°C	TO-99 (H-08A)	2.0 mV
AD741LN	0 to +70°C	Mini-DIP (N-8)	0.5 mV
AD741LH	0 to +70°C	TO-99 (H-08A)	0.5 mV
AD741H	−55°C to +125°C	TO-99 (H-08A)	5.0 mV
AD741SH	−55°C to +125°C	TO-99 (H-08A)	2.0 mV

NOTES
[1]J, K and S grade chips also available.
[2]See Section 20 for package outline information.

Typical Performance Curves

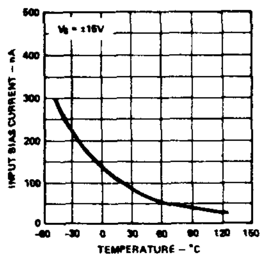


Figure 1. Input Bias Current vs. Temperature

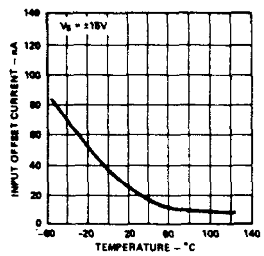


Figure 2. Input Offset Current vs. Temperature

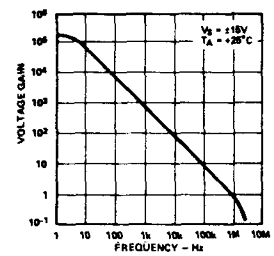


Figure 3. Open-Loop Gain vs. Frequency

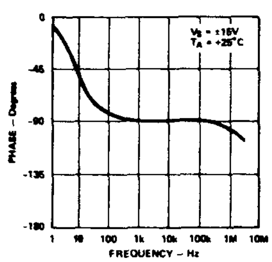


Figure 4. Open-Loop Phase Response vs. Frequency

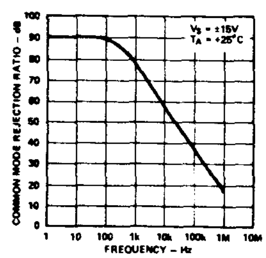


Figure 5. Common-Mode Rejection vs. Frequency

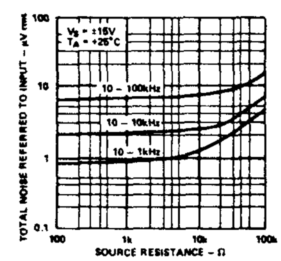


Figure 6. Broad Band Noise vs. Source Resistance

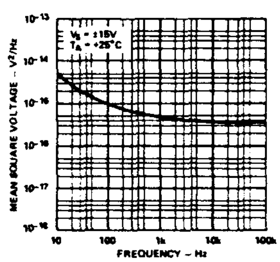


Figure 7. Input Noise Voltage vs. Frequency

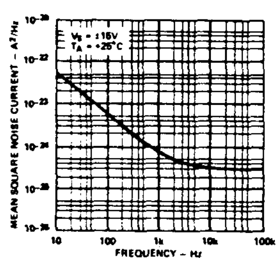


Figure 8. Input Noise Current vs. Frequency

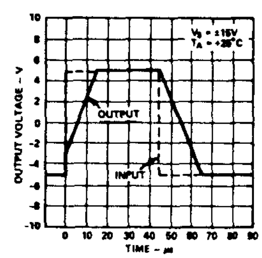


Figure 9. Voltage Follower Large Signal Pulse Response

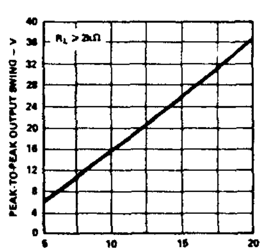


Figure 10. Output Voltage Swing vs. Supply Voltage

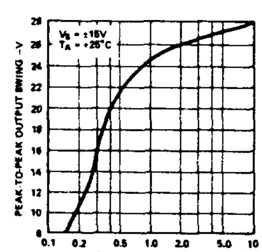


Figure 11. Output Voltage Swing vs. Load Resistance

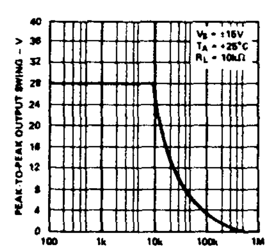


Figure 12. Output Voltage Swing vs. Frequency