Quad Precision, Low Cost, High Speed, BiFET Op Amp

AD713

FEATURES

Enhanced Replacement for LF347 and TL084

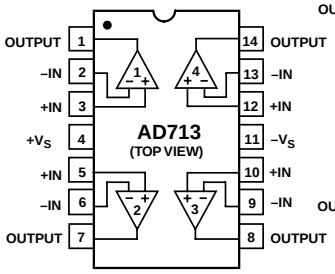
AC PERFORMANCE
1 ms Settling to 0.01% for 10 V Step
20 V/ms Slew Rate
0.0003% Total Harmonic Distortion (THD)
4 MHz Unity Gain Bandwidth

DC PERFORMANCE
0.5 mV max Offset Voltage (AD713K)
20 mV/°C max Drift (AD713K)
200 V/mV min Open Loop Gain (AD713K)
2 mV p-p typ Noise, 0.1 Hz to 10 Hz
True 14-Bit Accuracy
Single Version: AD711, Dual Version: AD712
Available in 16-Pin SOIC, 14-Pin Plastic DIP and Hermetic Cerdip Packages
Standard Military Drawing Available

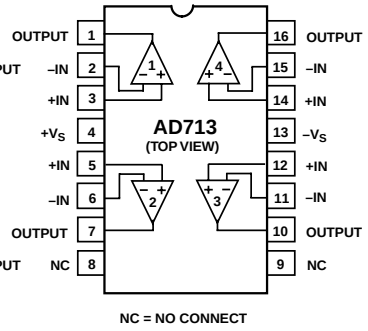
APPLICATIONS
Active Filters
Quad Output Buffers for 12- and 14-Bit DACs
Input Buffers for Precision ADCs
Photo Diode Preamplifier Application

CONNECTION DIAGRAMS

Plastic (N) and Cerdip (Q) Packages



SOIC (R) Package



NC = NO CONNECT

The AD713 is offered in a 16-pin SOIC, 14-pin plastic DIP and hermetic cerdip package.

PRODUCT DESCRIPTION

The AD713 is a quad operational amplifier, consisting of four AD711 BiFET op amps. These precision monolithic op amps offer excellent dc characteristics plus rapid settling times, high slew rates, and ample bandwidths. In addition, the AD713 provides the close matching ac and dc characteristics inherent to amplifiers sharing the same monolithic die.

The single-pole response of the AD713 provides fast settling: l µs to 0.01%. This feature, combined with its high dc precision, makes the AD713 suitable for use as a buffer amplifier for 12- or 14-bit DACs and ADCs. It is also an excellent choice for use in active filters in 12-, 14- and 16-bit data acquisition systems. Furthermore, the AD713's low total harmonic distortion (THD) level of 0.0003% and very close matching ac characteristics make it an ideal amplifier for many demanding audio applications.

The AD713 is internally compensated for stable operation at unity gain and is available in seven performance grades. The AD713J and AD713K are rated over the commercial temperature range of 0°C to 70°C. The AD713A and AD713B are rated over the industrial temperature of –40°C to +85°C. The AD713S and AD713T are rated over the military temperature range of –55°C to +125°C and are available processed to standard microcircuit drawings.

PRODUCT HIGHLIGHTS

1. The AD713 is a high speed BiFET op amp that offers excellent performance at competitive prices. It upgrades the performance of circuits using op amps such as the TL074, TL084, LT1058, LF347 and OPA404.
2. Slew rate is 100% tested for a guaranteed minimum of 16 V/µs (J, A and S Grades).
3. The combination of Analog Devices' advanced processing technology, laser wafer drift trimming and well-matched ion-implanted JFETs provides outstanding dc precision. Input offset voltage, input bias current and input offset current are specified in the warmed-up condition and are 100% tested.
4. Very close matching of ac characteristics between the four amplifiers makes the AD713 ideal for high quality active filter applications.

AD713—SPECIFICATIONS (V_S = ±15 V @ T_A = 25°C unless otherwise noted)

Parameter	Conditions	AD713J/A/S Min	AD713J/A/S Typ	AD713J/A/S Max	AD713K/B/T Min	AD713K/B/T Typ	AD713K/B/T Max	Unit
INPUT OFFSET VOLTAGE[1]								
Initial Offset			0.3	**1.5**		0.2	**0.5**	mV
Offset	T_{MIN} to T_{MAX}		0.5	2/2/**2**		0.4	**0.7**/**0.7**/**1.0**	mV
vs. Temp			5			5	20/**20**/**15**	µV/°C
vs. Supply		**78**	95		**84**	100		dB
	T_{MIN} to T_{MAX}	76/76/**76**	95		**84**	100		dB
Long-Term Stability			15			15		µV/Month
INPUT BIAS CURRENT[2]	V_{CM} = 0 V		40	**150**		40	**75**	pA
	V_{CM} = 0 V @ T_{MAX}			3.4/9.6/154			1.7/4.8/77	nA
	V_{CM} = ±10 V		55	200		55	**120**	pA
INPUT OFFSET CURRENT	V_{CM} = 0 V		10	**75**		10	**35**	pA
	V_{CM} = 0 V @ T_{MAX}			1.7/4.8/77			0.8/2.2/36	nA
MATCHING CHARACTERISTICS								
Input Offset Voltage			0.5	**1.8**		0.4	**0.8**	mV
	T_{MIN} to T_{MAX}		0.7	2.3/2.3/**2.3**		0.6	**1.0**/**1.0**/**1.3**	mV
Input Offset Voltage Drift			8			6	25	µV/°C
Input Bias Current			10	**100**		10	**35**	pA
Crosstalk	f = 1 kHz			–130			–130	dB
	f = 100 kHz			–95			–95	dB
FREQUENCY RESPONSE								
Small Signal Bandwidth	Unity Gain	3.0	4.0		3.4	4.0		MHz
Full Power Response	V_O = 20 V p-p		200			200		kHz
Slew Rate	Unity Gain	**16**	20		**18**	20		V/µs
Settling Time to 0.01%			1.0	1.2		1.0	1.2	µs
Total Harmonic Distortion	f = 1 kHz; R_L ≥ 2 kΩ; V_O = 3 V rms		0.0003			0.0003		%
INPUT IMPEDANCE								
Differential			$3\times10^{12}\|5.5$			$3\times10^{12}\|5.5$		Ω‖pF
Common Mode			$3\times10^{12}\|5.5$			$3\times10^{12}\|5.5$		Ω‖pF
INPUT VOLTAGE RANGE								
Differential[3]			±20			±20		V
Common-Mode Voltage[4]			+14.5, –11.5			+14.5, –11.5		V
	T_{MIN} to T_{MAX}	–11		+13	**–11**		+13	V
Common Mode	V_{CM} = ±10 V	**78**	88		**84**	94		dB
Rejection Ratio	T_{MIN} to T_{MAX}	76/76/**76**	84		**82**	90		dB
	V_{CM} = ±11 V	**72**	84		**78**	90		dB
	T_{MIN} to T_{MAX}	70/70/**70**	80		**74**	84		dB
INPUT VOLTAGE NOISE	0.1 Hz to 10 Hz		2			2		µV p-p
	f = 10 Hz		45			45		nV/√Hz
	f = 100 Hz		22			22		nV/√Hz
	f = 1 kHz		18			18		nV/√Hz
	f = 10 kHz		16			16		nV/√Hz
INPUT CURRENT NOISE	f = 1 kHz		0.01			0.01		pA/√Hz
OPEN-LOOP GAIN	V_O = ±10 V; R_L ≥ 2 kΩ	**150**	400		**200**	400		V/mV
	T_{MIN} to T_{MAX}	100/100/**100**			**100**			V/mV
OUTPUT CHARACTERISTICS								
Voltage	R_L ≥ 2 kΩ	+13, –12.5	+13.9, –13.3		+13, –12.5	+13.9, –13.3		V
	T_{MIN} to T_{MAX}	±12/±12/**±12**	+13.8, –13.1		**±12**	+13.8, –13.1		V
Current	Short Circuit		25			25		mA
POWER SUPPLY								
Rated Performance			±15			±15		V
Operating Range		**±4.5**		**±18**	**±4.5**		**±18**	V
Quiescent Current			10.0	**13.5**		10.0	**12.0**	mA
TRANSISTOR COUNT	# of Transistors		120			120		

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 temperatures, the current doubles every 10°C.

[3]Defined as voltage between inputs, such that neither exceeds ±10 V from ground.

[4]Typically exceeding –14.1 V negative common-mode voltage on either input results in an output phase reversal.

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS[1, 2]

Supply Voltage . . . . . ±18 V
Internal Power Dissipation[2]
Input Voltage[3] . . . . . ±18 V
Output Short-Circuit Duration
(For One Amplifier) . . . . . Indefinite
Differential Input Voltage . . . . . $+V_S$ and $-V_S$
Storage Temperature Range (Q) . . . . . –65°C to +150°C
Storage Temperature Range (N, R) . . . . . –65°C to +125°C
Operating Temperature Range
AD713J/K . . . . . 0°C to 70°C
AD713A/B . . . . . –40°C to +85°C
AD713S/T . . . . . –55°C to +125°C
Lead Temperature Range (Soldering 60 sec) . . . . . 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]Thermal Characteristics:
14-Pin Plastic Package: θ_{JC} = 30°C/Watt; θ_{JA} = 100°C/Watt
14-Pin Cerdip Package: θ_{JC} = 30°C/Watt; θ_{JA} = 110°C/Watt
16-Pin SOIC Package: θ_{JC} = 30°C/Watt; θ_{JA} = 100°C/Watt

[3]For supply voltages less than ±18 V, the absolute maximum input voltage is equal to the supply voltage.

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option[1]
AD713AQ	–40°C to +85°C	14-Pin Ceramic DIP	Q-14
AD713BQ	–40°C to +85°C	14-Pin Ceramic DIP	Q-14
AD713JN	0°C to 70°C	14-Pin Plastic DIP	N-14
AD713JR-16	0°C to 70°C	16-Pin Plastic SOIC	R-16
AD713JR-16-REEL	0°C to 70°C	16-Pin Plastic SOIC	R-16
AD713JR-16-REEL7	0°C to 70°C	16-Pin Plastic SOIC	R-16
AD713KN	0°C to 70°C	14-Pin Plastic DIP	N-14
AD713SQ[2]	–55°C to +125°C	14-Pin Ceramic DIP	Q-14
AD713TQ[2]	–55°C to +125°C	14-Pin Ceramic DIP	Q-14
5962-9063301MCA	–55°C to +125°C	14-Pin Ceramic DIP	Q-14
5962-9063302MCA[2]	–55°C to +125°C	14-Pin Ceramic DIP	Q-14

[1]N = Plastic DIP; Q = Cerdip; R = Small Outline IC (SOIC).
[2]Not for new designs. Obsolete April 2002.

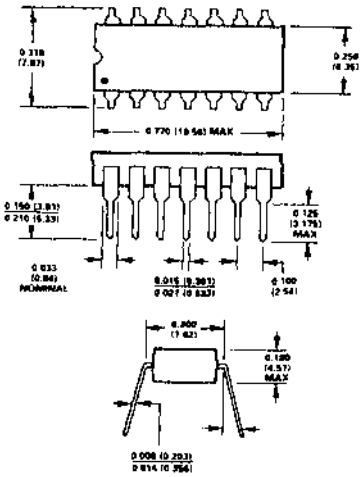
CAUTION

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 the AD713 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.

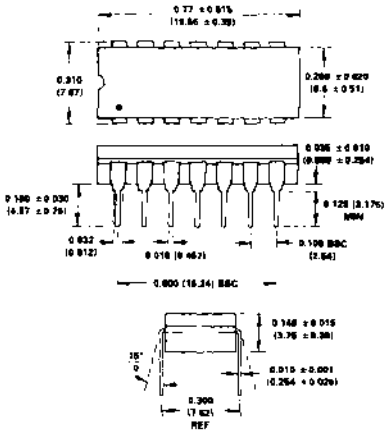
OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).

14-Pin Plastic (N-14A) DIP Package



14-Pin Cerdip (Q-14) Package



16-Pin SOIC (R-16) Package