Precision, Low Cost, High Speed, BiFET Op Amp

AD711

FEATURES

Enhanced Replacement for LF411 and TL081

AC PERFORMANCE

- **Settles to ±0.01% in 1.0 μs**
- **16 V/μs min Slew Rate (AD711J)**
- **3 MHz min Unity Gain Bandwidth (AD711J)**

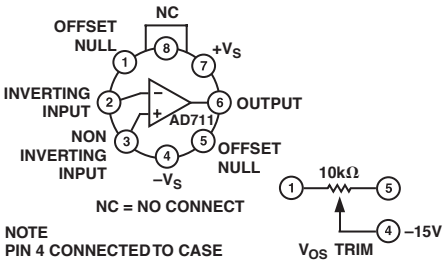
DC PERFORMANCE

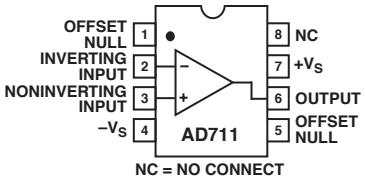
- **0.25 mV max Offset Voltage: (AD711C)**
- **3 μV/°C max Drift: (AD711C)**
- **200 V/mV min Open-Loop Gain (AD711K)**
- **4 μV p-p max Noise, 0.1 Hz to 10 Hz (AD711C)**
- **Available in Plastic Mini-DIP, Plastic SOIC, Hermetic Cerdip, and Hermetic Metal Can Packages**

MIL-STD-883B Parts Available

- **Available in Tape and Reel in Accordance with EIA-481A Standard**
- **Surface Mount (SOIC)**
- **Dual Version: AD712**

CONNECTION DIAGRAMS





PRODUCT DESCRIPTION

The AD711 is a high speed, precision monolithic operational amplifier offering high performance at very modest prices. Its very low offset voltage and offset voltage drift are the results of advanced laser wafer trimming technology. These performance benefits allow the user to easily upgrade existing designs that use older precision BiFETs and, in many cases, bipolar op amps.

The superior ac and dc performance of this op amp makes it suitable for active filter applications. With a slew rate of 16 V/μs and a settling time of 1 μs to ±0.01%, the AD711 is ideal as a buffer for 12-bit D/A and A/D Converters and as a high-speed integrator. The settling time is unmatched by any similar IC amplifier.

The combination of excellent noise performance and low input current also make the AD711 useful for photo diode preamps. Common-mode rejection of 88 dB and open loop gain of 400 V/mV ensure 12-bit performance even in high-speed unity gain buffer circuits.

The AD711 is pinned out in a standard op amp configuration and is available in seven performance grades. The AD711J and AD711K are rated over the commercial temperature range of 0°C to 70°C. The AD711A, AD711B and AD711C are rated over the industrial temperature range of –40°C to +85°C. The AD711S and AD711T are rated over the military temperature range of –40°C to +125°C and are available processed to MIL-STD-883B, REV. E.

Extended reliability PLUS screening is available, specified over the commercial and industrial temperature ranges. PLUS screening includes 168 hour burn-in, as well as other environmental and physical tests.

The AD711 is available in an 8-pin plastic mini-DIP, small outline, cerdip, TO-99 metal can, or in chip form.

PRODUCT HIGHLIGHTS

1. The AD711 offers excellent overall performance at very competitive prices.
2. Analog Devices' advanced processing technology and 100% testing guarantee a low input offset voltage (0.25 mV max, C grade, 2 mV max, J grade). Input offset voltage is specified in the warmed-up condition. Analog Devices' laser wafer drift trimming process reduces input offset voltage drifts to 3 μV/°C max on the AD711C.
3. Along with precision dc performance, the AD711 offers excellent dynamic response. It settles to ±0.01% in 1 μs and has a 100% tested minimum slew rate of 16 V/μs. Thus this device is ideal for applications such as DAC and ADC buffers which require a combination of superior ac and dc performance.
4. The AD711 has a guaranteed and tested maximum voltage noise of 4 μV p-p, 0.1 to 10 Hz (AD711C).
5. Analog Devices' well-matched, ion-implanted JFETs ensure a guaranteed input bias current (at either input) of 25 pA max (AD711C) and an input offset current of 10 pA max (AD711C). Both input bias current and input offset current are guaranteed in the warmed-up condition.

AD711—SPECIFICATIONS (V_S = ±15 V @ T_A = 25°C, unless otherwise noted.)

Parameter	J/A/S Min	J/A/S Typ	J/A/S Max	K/B/T Min	K/B/T Typ	K/B/T Max	C Min	C Typ	C Max	Unit
INPUT OFFSET VOLTAGE[1]										
Initial Offset		0.3	2/1/1		0.2	0.5		0.10	0.25	mV
T_{MIN} to T_{MAX}			3/2/2			1.0			0.45	mV
vs. Temp		7	20/20/20		5	10		2	5	µV/°C
vs. Supply	76	95		80	100		86	110		dB
T_{MIN} to T_{MAX}	76/76/76			80			86			dB
Long-Term Stability		15			15			15		µV/Month
INPUT BIAS CURRENT[2]										
V_{CM} = 0 V		15	50		15	50		15	25	pA
V_{CM} = 0 V @ T_{MAX}			1.1/3.2/51			1.1/3.2/51			1.6	nA
V_{CM} = ±10 V		20	100		20	100		20	50	pA
INPUT OFFSET CURRENT										
V_{CM} = 0 V		10	25		5	25		5	10	pA
V_{CM} = 0 V @ T_{MAX}			0.6/1.6/26			0.6/1.6/26			0.65	nA
FREQUENCY RESPONSE										
Small Signal Bandwidth	3.0	4.0		3.4	4.0		3.4	4.0		MHz
Full Power Response		200			200			200		kHz
Slew Rate	16	20		18	20		18	20		V/µs
Settling Time to 0.01%		1.0	1.2		1.0	1.2		1.0	1.2	µs
Total Harmonic Distortion		0.0003			0.0003			0.0003		%
INPUT IMPEDANCE										
Differential		$3 \times 10^{12} \| 5.5$			$3 \times 10^{12} \| 5.5$			$3 \times 10^{12} \| 5.5$		Ω‖pF
Common Mode		$3 \times 10^{12} \| 5.5$			$3 \times 10^{12} \| 5.5$			$3 \times 10^{12} \| 5.5$		Ω‖pF
INPUT VOLTAGE RANGE										
Differential[3]		±20			±20			±20		V
Common-Mode Voltage[4]		+14.5, –11.5			+14.5, –11.5			+14.5, –11.5		
T_{MIN} to T_{MAX}	$-V_S$ + 4		$+V_S$ – 2	$-V_S$ + 4		$+V_S$ – 2	$-V_S$ + 4		+V – 2	V
Common-Mode Rejection Ratio										
V_{CM} = ±10 V	76	88		80	88		86	94		dB
T_{MIN} to T_{MAX}	76/76/76	84		80	84		86	90		dB
V_{CM} = ±11 V	70	84		76	84		76	90		dB
T_{MIN} to T_{MAX}	70/70/70	80		74	80		74	84		dB
INPUT VOLTAGE NOISE		2			2			2	4	µV p-p
		45			45			45		nV/√Hz
		22			22			22		nV/√Hz
		18			18			18		nV/√Hz
		16			16			16		nV/√Hz
INPUT CURRENT NOISE		0.01			0.01			0.01		pA/√Hz
OPEN-LOOP GAIN	150	400		200	400		200	400		V/mV
	100/100/100			100			100			V/mV
OUTPUT CHARACTERISTICS										
Voltage	+13, –12.5	+13.9, –13.3		+13, –12.5	+13.9, –13.3		+13, –12.5	+13.9, –13.3		V
	±12/±12/±12	+13.8, –13.1		±12	+13.8, –13.1		±12	+13.8, –13.1		V
Current		25			25			25		mA
POWER SUPPLY										
Rated Performance		±15			±15			±15		V
Operating Range	±4.5		±18	±4.5		±18	±4.5		±18	V
Quiescent Current		2.5	3.4		2.5	3.0		2.5	2.8	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 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]

Supply Voltage . . . . . ±18 V
Internal Power Dissipation[2] . . . . . 500 mW
Input Voltage[3] . . . . . ±18 V
Output Short Circuit Duration . . . . . Indefinite
Differential Input Voltage . . . . . $+V_S$ and $-V_S$
Storage Temperature Range (Q, H) . . . . . –65°C to +150°C
Storage Temperature Range (N) . . . . . –65°C to +125°C
Operating Temperature Range
AD711J/K . . . . . 0°C to +70°C
AD711A/B/C . . . . . –40°C to +85°C
AD711S/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:
8-Pin Plastic Package: θ_{JC} = 33°C/Watt; θ_{JA} = 100°C/Watt
8-Pin Cerdip Package: θ_{JC} = 22°C/Watt; θ_{JA} = 110°C/Watt
8-Pin Metal Can Package: θ_{JC} = 65°C/Watt; θ_{JA} = 150°C/Watt
8-Pin SOIC Package: θ_{JC} = 43°C/Watt; θ_{JA} = 160°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*
*AD711AH	–40°C to +85°C	8-Pin Metal Can	H-08A
AD711AQ	–40°C to +85°C	8-Pin Ceramic DIP	Q-8
*AD711BQ	–40°C to +85°C	8-Pin Ceramic DIP	Q-8
*AD711CH	–40°C to +85°C	8-Pin Metal Can	H-08A
AD711JN	0°C to 70°C	8-Pin Plastic DIP	N-8
AD711JR	0°C to 70°C	8-Pin Plastic SOIC	RN-8
AD711JR-REEL	0°C to 70°C	8-Pin Plastic SOIC	RN-8
AD711JR-REEL7	0°C to 70°C	8-Pin Plastic SOIC	RN-8
AD711KN	0°C to 70°C	8-Pin Plastic DIP	N-8
AD711KR	0°C to 70°C	8-Pin Plastic SOIC	RN-8
AD711KR-REEL	0°C to 70°C	8-Pin Plastic SOIC	RN-8
AD711KR-REEL7	0°C to 70°C	8-Pin Plastic SOIC	RN-8
*AD711SQ/883B	–55°C to +125°C	8-Pin Ceramic DIP	Q-8
*AD711TQ/883B	–55°C to +125°C	8-Pin Ceramic DIP	Q-8

*Not for new design, obsolete April 2002

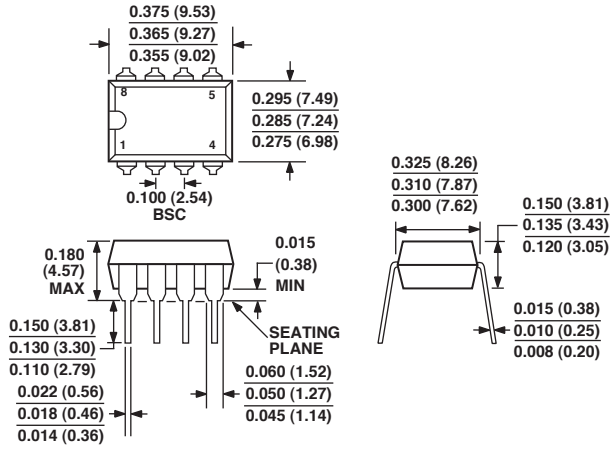
CAUTION

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 AD711 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

8-Lead Plastic Dual-in-Line Package [PDIP]
(N-8)

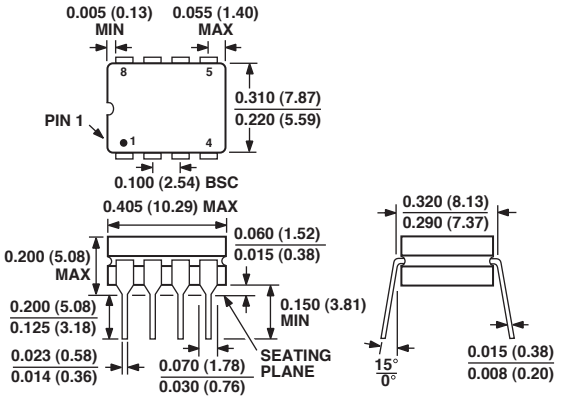
Dimensions shown in inches and (millimeters)



COMPLIANT TO JEDEC STANDARDS MO-095AA
CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETERS DIMENSIONS (IN PARENTHESES)

8-Lead Ceramic Dip – Glass Hermetic Seal [CERDIP]
(Q-8)

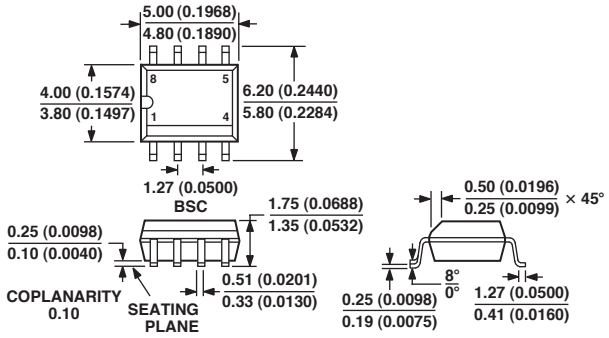
Dimensions shown in inches and (millimeters)



CONTROLLING DIMENSIONS ARE IN INCH; MILLIMETERS DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF MILLIMETER EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN

8-Lead Standard Small Outline Package [SOIC]
Narrow Body
(RN-8)

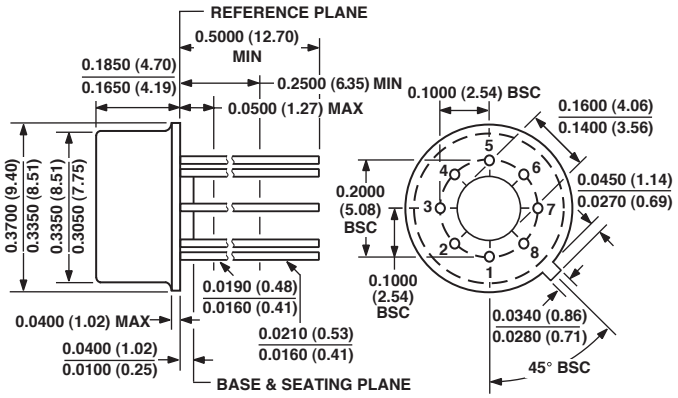
Dimensions shown in millimeters and (inches)



COMPLIANT TO JEDEC STANDARDS MS-012AA
CONTROLLING DIMENSIONS ARE IN MILLIMETERS; INCH DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF MILLIMETER EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN

8-Lead Metal Can [TO-99]
(H-8)

Dimensions shown in inches and (millimeters)



COMPLIANT TO JEDEC STANDARDS MO-002AK
CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETERS DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN