ANALOG DEVICES

Low Cost, Miniature Isolation Amplifiers

AD202/AD204

FEATURES
Small Size: 4 Channels/Inch
Low Power: 35 mW (AD204)
High Accuracy: ±0.025% Max Nonlinearity (K Grade)
High CMR: 130 dB (Gain = 100 V/V)
Wide Bandwidth: 5 kHz Full-Power (AD204)
High CMV Isolation: ±2000 V pk Continuous (K Grade) (Signal and Power)
Isolated Power Outputs
Uncommitted Input Amplifier

APPLICATIONS
Multichannel Data Acquisition
Current Shunt Measurements
Motor Controls
Process Signal Isolation
High Voltage Instrumentation Amplifier

GENERAL DESCRIPTION

The AD202 and AD204 are general purpose, two-port, transformer-coupled isolation amplifiers that may be used in a broad range of applications where input signals must be measured, processed, and/or transmitted without a galvanic connection. These industry standard isolation amplifiers offer a complete isolation function, with both signal and power isolation provided for in a single compact plastic SIP or DIP style package. The primary distinction between the AD202 and the AD204 is that the AD202 is powered directly from a 15 V dc supply while the AD204 is powered by an externally supplied clock, such as the recommended AD246 Clock Driver.

The AD202 and AD204 provide total galvanic isolation between the input and output stages of the isolation amplifier through the use of internal transformer-coupling. The functionally complete AD202 and AD204 eliminate the need for an external, user-supplied dc-to-dc converter. This permits the designer to minimize the necessary circuit overhead and consequently reduce the overall design and component costs.

The design of the AD202 and AD204 emphasizes maximum flexibility and ease of use, including the availability of an uncommitted op amp on the input stage. They feature a bipolar ±5 V output range, an adjustable gain range of from 1V/V to 100 V/V, ±0.025% max nonlinearity (K grade), 130 dB of CMR, and the AD204 consumes a low 35 mW of power.

The functional block diagrams can be seen in Figures 1a and 1b.

PRODUCT HIGHLIGHTS

The AD202 and AD204 are full-featured isolators offering numerous benefits to the user:

Small Size: The AD202 and AD204 are available in SIP and DIP form packages. The SIP package is just 0.25" wide, giving the user a channel density of four channels per inch. The isolation barrier is positioned to maximize input to output spacing. For applications requiring a low profile, the DIP package provides a height of just 0.350".

High Accuracy: With a maximum nonlinearity of ±0.025% for the AD202K/AD204K (±0.05% for the AD202J/AD204J) and low drift over temperature, the AD202 and AD204 provide high isolation without loss of signal integrity.

Low Power: Power consumption of 35 mW (AD204) and 75 mW (AD202) over the full signal range makes these isolators ideal for use in applications with large channel counts or tight power budgets.

Wide Bandwidth: The AD204's full-power bandwidth of 5 kHz makes it useful for wideband signals. It is also effective in applications like control loops, where limited bandwidth could result in instability.

Excellent Common-Mode Performance: The AD202K/AD204K provide ±2000 V pk continuous common-mode isolation, while the AD202J/AD204J provide ±1000 V pk continuous common-mode isolation. All models have a total common-mode input capacitance of less than 5 pF inclusive of power isolation. This results in CMR ranging from 130 dB at a gain of 100 dB to 104 dB (minimum at unity gain) and very low leakage current (2 µA maximum).

Flexible Input: An uncommitted op amp is provided at the input of all models. This provides buffering and gain as required, and facilitates many alternative input functions including filtering, summing, high voltage ranges, and current (transimpedance) input.

Isolated Power: The AD204 can supply isolated power of ±7.5 V at 2 mA. This is sufficient to operate a low-drift input preamp, provide excitation to a semiconductor strain gage, or power any of a wide range of user-supplied ancillary circuits. The AD202 can supply ±7.5 V at 0.4 mA, which is sufficient to operate adjustment networks or low power references and op amps, or to provide an open-input alarm.

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AD202/AD204–SPECIFICATIONS (Typical @ 25°C and V_S = 15 V unless otherwise noted.)

Model	AD204J	AD204K	AD202J	AD202K
GAIN				
Range	1 V/V–100 V/V	*	*	*
Error	±0.5% typ (±4% max)	*	*	*
vs. Temperature	±20 ppm/°C typ (±45 ppm/°C max)	*	*	*
vs. Time	±50 ppm/1000 Hours	*	*	*
vs. Supply Voltage	±0.01%/V	±0.01%/V	±0.01%/V	±0.01%/V
Nonlinearity (G = 1 V/V)[1]	±0.05% max	±0.025% max	±0.05% max	±0.025% max
Nonlinearity vs. Isolated Supply Load	±0.0015%/mA	*	*	*
INPUT VOLTAGE RATINGS				
Input Voltage Range	±5 V	*	*	*
Max Isolation Voltage (Input to Output)				
AC, 60 Hz, Continuous	750 V rms	1500 V rms	750 V rms	1500 V rms
Continuous (AC and DC)	±1000 V Peak	±2000 V Peak	±1000 V Peak	±2000 V Peak
Isolation-Mode Rejection Ratio (IMRR) @ 60 Hz				
R_S ≤ 100 Ω (HI and LO Inputs) G = 1 V/V	110 dB	110 dB	105 dB	105 dB
G = 100 V/V	130 dB	*	*	*
R_S ≤ 1 kΩ (Input HI, LO, or Both) G = 1 V/V	104 dB min	104 dB min	100 dB min	100 dB min
G = 100 V/V	110 dB min	*	*	*
Leakage Current Input to Output @ 240 V rms, 60 Hz	2 µA rms max	*	*	*
INPUT IMPEDANCE				
Differential (G = 1 V/V)	10^{12} Ω	*	*	*
Common-Mode	2 GΩ‖4.5 pF	*	*	*
INPUT BIAS CURRENT				
Initial, @ 25°C	±30 pA	*	*	*
vs. Temperature (0°C to 70°C)	±10 nA	*	*	*
INPUT DIFFERENCE CURRENT				
Initial, @ 25°C	±5 pA	*	*	*
vs. Temperature (0°C to 70°C)	±2 nA	*	*	*
INPUT NOISE				
Voltage, 0.1 Hz to 100 Hz	4 µV p-p	*	*	*
f > 200 Hz	50 nV/$\sqrt{Hz}$	*	*	*
FREQUENCY RESPONSE				
Bandwidth (V_O ≤ 10 V p-p, G = 1 V–50 V/V)	5 kHz	5 kHz	2 kHz	2 kHz
Settling Time, to ±10 mV (10 V Step)	1 ms	*	*	*
OFFSET VOLTAGE (RTI)				
Initial, @ 25°C Adjustable to Zero	(±15 ±15/G)mV max	(±5 ± 5/G) mV max	(±15 ±15/G) mV max	(±5 ±5/G) mV max
vs. Temperature (0°C to 70°C)	$\left(\pm 10 \pm \frac{10}{G}\right)$µV/°C	*	*	*
RATED OUTPUT				
Voltage (Out HI to Out LO)	±5 V	*	*	*
Voltage at Out HI or Out LO (Ref. Pin 32)	±6.5 V	*	*	*
Output Resistance	3 kΩ	3 kΩ	7 kΩ	7 kΩ
Output Ripple, 100 kHz Bandwidth	10 mV p-p	*	*	*
5 kHz Bandwidth	0.5 mV rms	*	*	*
ISOLATED POWER OUTPUT[2]				
Voltage, No Load	±7.5 V	*	*	*
Accuracy	±10%	*	*	*
Current	2 mA (Either Output)[3]	2 mA (Either Output)[3]	400 µA Total	400 µA Total
Regulation, No Load to Full Load	5%	*	*	*
Ripple	100 mV p-p	*	*	*
OSCILLATOR DRIVE INPUT				
Input Voltage	15 V p-p Nominal	15 V p-p Nominal	N/A	N/A
Input Frequency	25 kHz Nominal	25 kHz Nominal	N/A	N/A
POWER SUPPLY (AD202 Only)				
Voltage, Rated Performance	N/A	N/A	15 V ± 5%	15 V ± 5%
Voltage, Operating	N/A	N/A	15 V ± 10%	15 V ± 10%
Current, No Load (V_S = 15 V)	N/A	N/A	5 mA	5 mA
TEMPERATURE RANGE				
Rated Performance	0°C to 70°C	*	*	*
Operating	–40°C to +85°C	*	*	*
Storage	–40°C to +85°C	*	*	*
PACKAGE DIMENSIONS[4]				
SIP Package (Y)	2.08" × 0.250" × 0.625"	*	*	*
DIP Package (N)	2.10" × 0.700" × 0.350"	*	*	*

NOTES
*Specifications same as AD204J.
[1]Nonlinearity is specified as a % deviation from a best straight line.
[2]1.0 µF min decoupling required (see text).
[3]3 mA with one supply loaded.
[4]Width is 0.25" typ, 0.26" max.
Specifications subject to change without notice.

AD246–SPECIFICATIONS
(Typical @ 25°C and V_S = 15 V unless otherwise noted.)

Model	AD246JY	AD246JN
OUTPUT[1]		
Frequency	25 kHz Nominal	*
Voltage	15 V p-p Nominal	*
Fan-Out	32 Max	*
POWER SUPPLY REQUIREMENTS		
Input Voltage	15 V ± 5%	*
Supply Current		
Unloaded	35 mA	*
Each AD204 Adds	2.2 mA	*
Each 1 mA Load on AD204 $+V_{ISO}$ or $-V_{ISO}$ Adds	0.7 mA	*

NOTES
*Specifications the same as the AD246JY.
[1]The high current drive output will not support a short to ground.
Specifications subject to change without notice.

AD246 Pin Designations

Pin (Y)	Pin (N)	Function
1	12	15 V POWER IN
2	1	CLOCK OUTPUT
12	14	COMMON
13	24	COMMON

PIN DESIGNATIONS

AD202/AD204 SIP Package

Pin	Function
1	+INPUT
2	INPUT/V_{ISO} COMMON
3	–INPUT
4	INPUT FEEDBACK
5	$-V_{ISO}$ OUTPUT
6	$+V_{ISO}$ OUTPUT
31	15 V POWER IN (AD202 ONLY)
32	CLOCK/POWER COMMON
33	CLOCK INPUT (AD204 ONLY)
37	OUTPUT LO
38	OUTPUT HI

AD202/AD204 DIP Package

Pin	Function
1	+INPUT
2	INPUT/V_{ISO} COMMON
3	–INPUT
18	OUTPUT LO
19	OUTPUT HI
20	15 V POWER IN (AD202 ONLY)
21	CLOCK INPUT (AD204 ONLY)
22	CLOCK/POWER COMMON
36	$+V_{ISO}$ OUTPUT
37	$-V_{ISO}$ OUTPUT
38	INPUT FEEDBACK

ORDERING GUIDE

Model	Package Option	Max Common-Mode Voltage (Peak)	Max Linearity
AD202JY	SIP	1000 V	±0.05%
AD202KY	SIP	2000 V	±0.025%
AD202JN	DIP	1000 V	±0.05%
AD202KN	DIP	2000 V	±0.025%
AD204JY	SIP	1000 V	±0.05%
AD204KY	SIP	2000 V	±0.025%
AD204JN	DIP	1000 V	±0.05%
AD204KN	DIP	2000 V	±0.025%

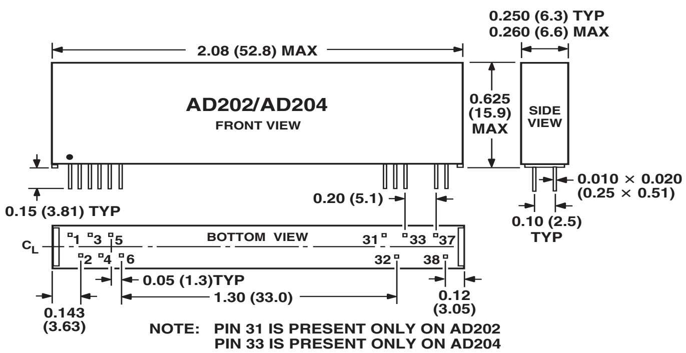
CAUTION

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 AD202/AD204 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

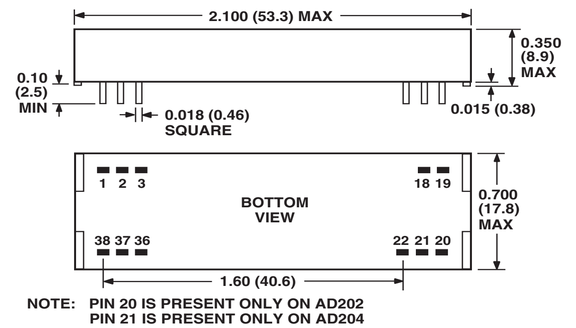
Dimensions shown in inches and (millimeters)

AD202/AD204 SIP Package



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

AD202/AD204 DIP Package



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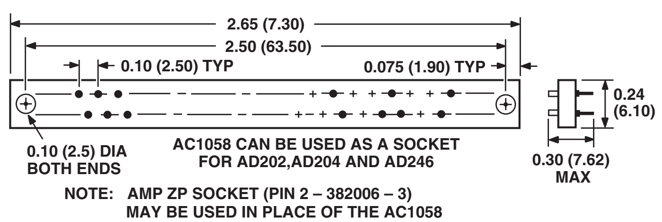
AC1058 Mating Socket



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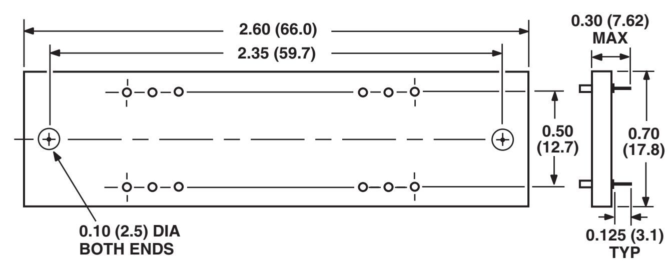
AC1060 Mating Socket



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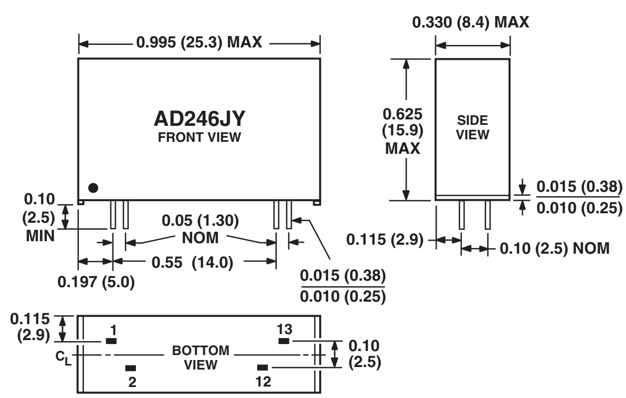
AD246JY Package



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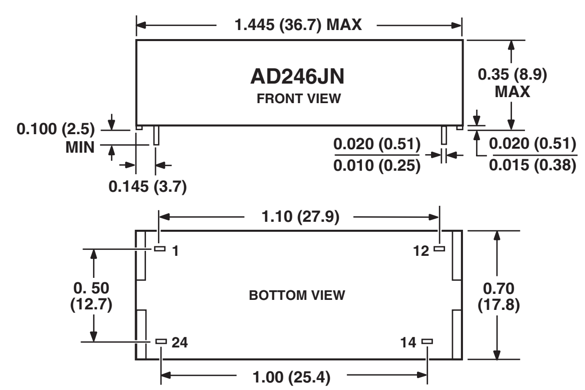
AD246JN Package



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