ANALOG DEVICES

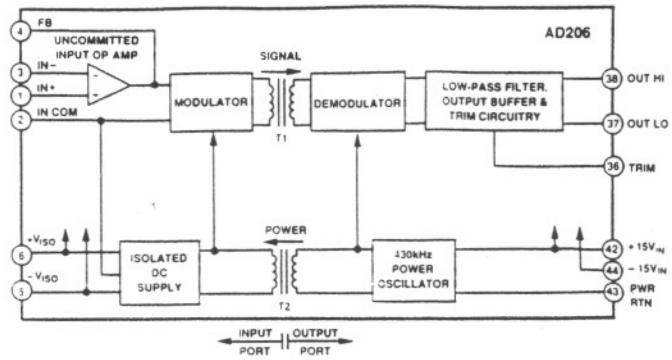
100 kHz Bandwidth, Low Distortion, Internally Powered Isolation Amplifier

AD206

FEATURES
- Wide Bandwidth: 100 kHz, min (Full Power)
- Fast Settling Time: 12 μs, max
- Low Harmonic Distortion: −80 dB @ 1 kHz
- Low Nonlinearity: ±0.005%
- Wide Output Range: ±10 V, min
- High CMV Isolation: 1.5 kV RMS, min
- Buffered Output
- Isolated Power: ±15 V DC @ ±10 mA
- Performance Rated over −40°C to +85°C

APPLICATIONS INCLUDE
- High Speed Data Acquisition Systems
- Transient Monitoring
- Power Line Monitoring
- Motor Control
- Vibration Analysis

AD206 FUNCTIONAL BLOCK DIAGRAM



GENERAL DESCRIPTION

The AD206 is a high speed, two-port, transformer-coupled isolation amplifier expressly designed for applications that require the amplification and isolation of extremely fast analog signals. The innovative circuit and transformer design of the AD206 ensures the wideband dynamic characteristics of the AD206 while preserving the key dc performance specifications.

The AD206 provides total galvanic isolation between the input and output stages of the isolation amplifier, including the power supplies, through the use of internal transformer coupling. The functionally complete design of the AD206, powered by a bipolar ±15 V dc supply, eliminates the need for a user supplied isolated dc/dc converter. This permits the designer to minimize the necessary circuit overhead and consequently reduce the overall system design and component costs.

The design of the AD206 emphasizes maximum flexibility and ease of use in a broad range of applications where rapidly varying analog signals must be measured and transmitted under high CMV conditions. The AD206 has a ±10 V input/output range, a specified gain range of 1 to 10, a buffered output and a front-end power supply of ±15 V dc with ±10 mA of current drive capability.

PRODUCT HIGHLIGHTS

High Speed Dynamic Characteristics: The AD206 features a minimum full power bandwidth of 100 kHz, a typical risetime of 3 μs and a maximum settling time of 12 μs. The high speed performance of the AD206 allows for the amplification and isolation of dynamic signals.

Flexible Input and Buffered Output Stages: An uncommitted op amp is provided on the input stage of the AD206. This allows for input buffering and gain as needed. The AD206 also features a buffered output stage, allowing it to drive low impedance loads.

High Accuracy: Exhibiting a typical nonlinearity of ±0.005% (B grade) of full-scale range and a total harmonic distortion of −80 dB (typical @ 1 kHz), the AD206 provides high isolation without loss of signal integrity and quality.

Excellent Common-Mode Performance: The AD206BY (AD206AY) provides 1.5 kV rms (0.75 kV rms) of common-mode protection. Both grades feature a low common-mode capacitance of 4.5 pF, inclusive of power isolation, resulting in a typical common-mode rejection specification of 105 dB (1 kΩ source impedance imbalance) as well as a low leakage current of 2.0 μA rms (max @ 240 V rms, 60 Hz).

Isolated Power: An unregulated isolated ±15 V dc power supply with ±10 mA of current drive capability is available at the input port of the AD206. This permits the isolator to power up floating signal conditioners, front-end amplifiers or remote transducers at the input.

Performance Rated over the −40°C to +85°C Temperature Range: With an extended industrial temperature range rating, the AD206 is an ideal isolation amplifier for use in industrial environments.

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SPECIFICATIONS (typical @ +25°C, V_S = ±15 V dc, 2 kΩ output load, unless noted otherwise)

	AD206A	AD206B
GAIN		
Range[1]	1 V/V to 10 V/V	*
Error	0 to −0.5% (0 to −1.5%, max)	*
vs. Temperature[2]		
0 to +85°C	+15 ppm/°C (+55 ppm/°C, max)	*
−40°C to 0°C	+50 ppm/°C (+100 ppm/°C, max)	*
vs. Supply Voltage, ±14.5 V to 16.5 V dc	100 ppm/V	*
vs. Isolated Supply Load[3]	20 ppm/mA	*
Nonlinearity,[4] ±10 V Output Swing, G = 1 V/V	±0.01% (±0.025%, max)	±0.005% (±0.015%, max)
G = 10 V/V	±0.025%	±0.01%
INPUT VOLTAGE RATINGS		
Input Voltage Rating of the Uncommitted Input		
Bipolar Op Amp, G = 1 V/V	±10 V, min	*
Max Safe Differential Range, IN+/IN− to IN COM	±15 V	*
Common Mode Rejection Ratio of Input Op Amp	100 dB (90 dB, min)	*
Max Isolation Voltage (Input to Output)		
AC, 60 Hz, Continuous	750 V RMS	1500 V RMS
Continuous (AC & DC)	±1000 V_{PEAK}	±2000 V_{PEAK}
Isolation-Mode Rejection Ratio (IMRR) @ 60 Hz		
R_S ≤ 100 Ω (HI & LO Inputs), G = 1 V/V	120 dB (110 dB, min)	*
R_S ≤ 1 kΩ (Input, HI, LO or Both), G = 1 V/V	105 dB	*
Isolation-Mode Rejection Ratio (IMRR) @ 1 kHz		
R_S ≤ 100 Ω (HI & LO Inputs), G = 1 V/V	100 dB	*
R_S ≤ 1 kΩ (Input, HI, LO or Both), G = 1 V/V	85 dB	*
Isolation-Mode Rejection Ratio (IMRR) @ 10 kHz		
R_S ≤ 100 Ω (HI & LO Inputs), G = 1 V/V	80 dB	*
R_S ≤ 1 kΩ (Input, HI, LO or Both), G = 1 V/V	65 dB	*
Leakage Current, Input to Output,		
[illegible]	[illegible] RMS, max	
INPUT IMPEDANCE		
Differential (G = 1 V/V)	16 MΩ	*
Common Mode	2 GΩ‖4.5 pF	*
INPUT OFFSET VOLTAGE		
Initial @ +25°C	±400 μV (±2 mV, max)	*
vs. Temperature		
0 to +85°C	±2 μV/°C (±15 μV/°C, max)	*
−40°C to 0°C	±20 μV/°C	*
OUTPUT OFFSET VOLTAGE		
Initial @ +25°C (Adjustable to Zero)	−45 mV (0 to −80 mV, max)	*
vs. Temperature		
0 to +85°C	±30 μV/°C (±65 μV/°C, max)	*
−40°C to 0°C	±80 μV/°C	*
vs. Supply Voltage	±350 μV/V	*
vs. Isolated Supply Load[3]	+35 μV/mA	*
INPUT BIAS CURRENT		
Initial @ +25°C	300 nA (650 nA, max)	*
vs. Temperature		
−40°C to +85°C	±800 nA, max	*
INPUT DIFFERENCE CURRENT		
Initial @ +25°C	3 nA (±65 nA, max)	*
vs. Temperature		
−40°C to +85°C	300 nA, max	*
INPUT VOLTAGE NOISE		
Frequency > 10 Hz	20 nV/√Hz	*
DYNAMIC RESPONSE (2 kΩ load)		
Full Signal Bandwidth (3 dB Corner, G = 1 V/V, 20 V pk–pk Signal)	110 kHz (100 kHz, min)	*

	AD206A	AD206B
DYNAMIC RESPONSE		
Small Signal Bandwidth (3 dB Corner,		
G = 1 V/V, 100 mV pk–pk Signal	115 kHz	*
Transport Delay	2.2 µs[5]	*
Rise Time (10% to 90%)	3 µs	*
Settling Time to ±0.10% on a 10 V Step	12 µs, max	*
Overshoot	0.5%	*
Harmonic Distortion Components, @ 1 kHz	−80 dB	*
@ 10 kHz	−65 dB	*
Unity Gain Overload Recovery (±15 V Drive)	5 µs	*
Output Overload Recovery Time (G = 5 V/V)	10 µs	*
RATED OUTPUT		
Voltage (Out HI to Out LO)	±10 V, min	*
Current	±5 mA, min (into 2 kΩ Load)	*
Maximum Capacitive Load	1,000 pF	*
Output Resistance	1 Ω, max	*
Output Ripple[6]		
1 MHz Bandwidth	10 mV pk–pk	*
50 kHz Bandwidth	2.5 mV pk–pk	*
ISOLATED POWER OUTPUT[7]		
Voltage, No Load	±15 V	*
vs. Temperature		
0 to +85°C	+20 mV/°C	*
−40°C to 0°C	+25 mV/°C	*
Accuracy (10 mA Load)	−5%, +15%	*
Current with Rated Supply Voltage Range[3,8]	±10 mA	*
Regulation, No Load to Full Load	−90 mV/mA	*
Line Regulation	290 mV/V	*
Ripple, 1 MHz Bandwidth, No Load[3]	50 mV RMS	*
Efficiency	75%	*
POWER SUPPLY[6]		
Supply Voltage for Rated Performance	±14.5 V DC to ±16.5 V DC	*
Voltage, Operating[9]	±14.25 V DC to ±17 V DC	*
Current, Quiescent	+40 mA/−18 mA	*
TEMPERATURE RANGE		
Rated Performance	−40°C to +85°C	*
Storage	−40°C to +85°C	*
PACKAGE DIMENSIONS		
SIP Package	2.475" × 0.3250" × 0.840", max	*
	62.9 mm × 8.3 mm × 21.3 mm, max	*

NOTES

[1] The gain range of the AD206 is specified from 1 to 10 V/V. The AD206 can also be used with gains of up to 100 V/V. With a gain of 100 V/V there will be a 20% reduction in the 3 dB bandwidth specification, and the nonlinearity will degrade to ±0.02% (typ). Refer to Figure 12 for a description on how to implement a gain of 100 using the AD206.

[2] The gain temperature coefficient for the AD206 is illustrated over the entire −40°C to +85°C rated performance temperature range in Figure 1.

[3] When the isolated supply load exceeds ±1 mA, external filter capacitors will be required in order to ensure that the gain, offset and nonlinearity specifications will be preserved and to maintain the isolated supply full load ripple below the specified 50 mV rms. A value of 6.8 µF is recommended.

[4] Nonlinearity is specified as a percent (of full-scale range) deviation from a best straight line.

[5] Equivalent to a 0.8° phase shift at 1 kHz.

[6] With the ±15 V dc power supply pins bypassed by 2.2 µF capacitors at the AD206 pins.

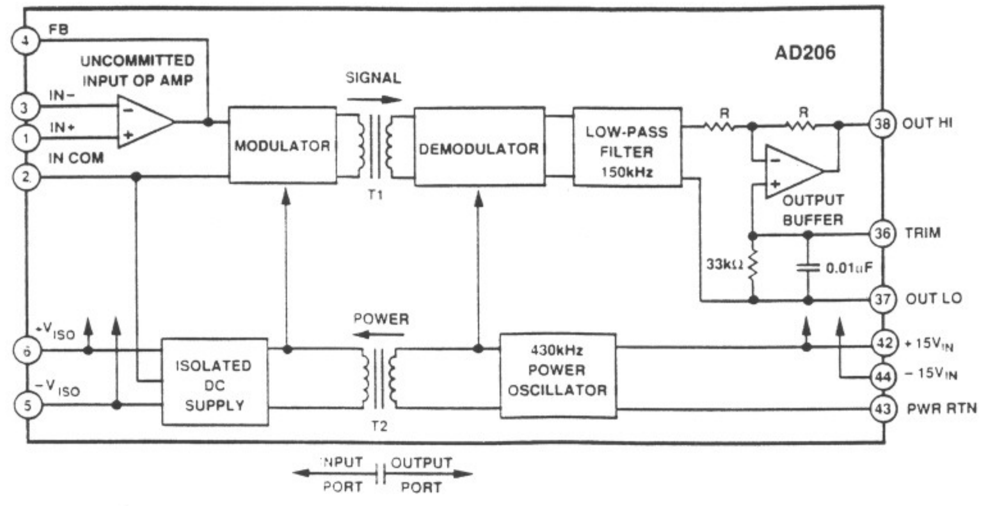
[7] CAUTION: The AD206 design does not provide short circuit protection of its isolated power supply. A current limiting resistor may be placed in series with the isolated power terminals and the load in order to protect the supply against inadvertent shorts.

[8] With an input power supply voltage greater than or equal to ±15 V dc the AD206 may supply up to ±15 mA of current from the isolated power supplies. Exceeding these currents will increase the dependence of the gain and offset specifications of the AD206 on both the supply voltage and isolated load current.

[9] Voltages less than 14.25 V dc may cause the AD206 to cease operating properly. Voltages greater than 17.5 V dc may damage the internal components of the AD206 and consequently should not be used.

*Specification is the same as that for the AD206A.

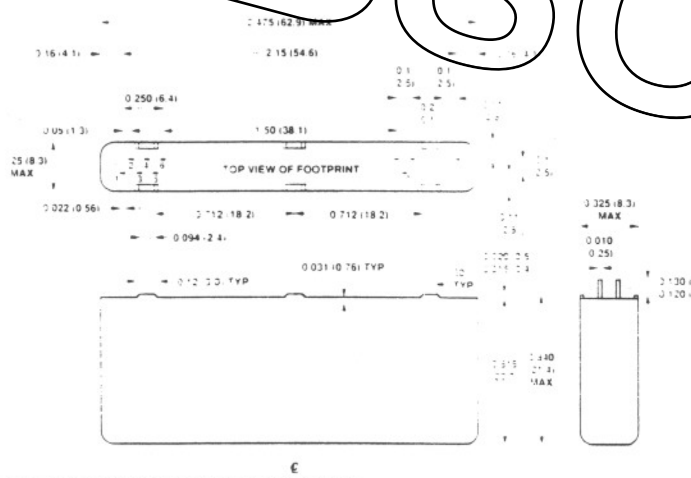
Specifications subject to change without notice.



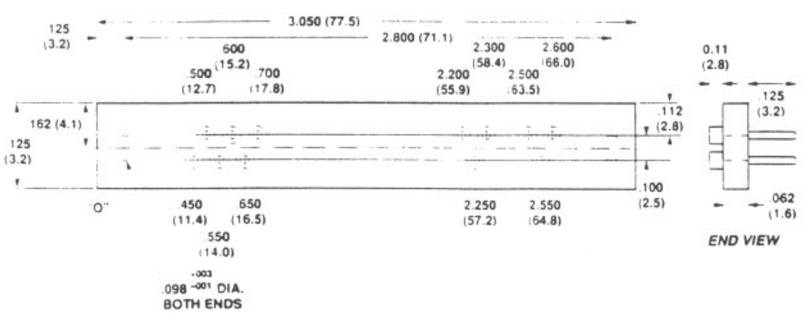
Functional Block Diagram

OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).



NOTE: PINS MEASURE 0.022 (0.56) ± 0.010 (0.25) PRIOR TO TINNING. TINNING MAY ADD UP TO 3 mils (0.003") TO THESE DIMENSIONS.



AD206 PIN DESIGNATIONS

Pin	Designation	Function
1	IN+	Input Op Amp: Noninverting Input
2	IN COM	Input Common
3	IN−	Input Op Amp: Inverting Input
4	FB	Input Feedback
5	$-V_{ISO}$ OUT	Isolated Power: −DC
6	$+V_{ISO}$ OUT	Isolated Power: +DC
36	TRIM	Output Offset Trim Adjustment
37	OUT LO	Output Low
38	OUT HI	Output High
42	+15 V IN	DC Power Supply Input: +15 V
43	PWR RTN	DC Power Supply Input Common
44	−15 V IN	DC Power Supply Input: −15 V

AD206 ORDERING GUIDE

Model	Temperature Range	Price (1–24)	Price (100s)
AD206AY	−40°C to +85°C	$74	$46
AD206BY	−40°C to +85°C	$80	$50

CAUTION

ESD (electrostatic discharge) sensitive device. Permanent damage may occur on unconnected devices subject to high energy electrostatic fields. Unused devices must be stored in conductive foam or shunts. The protective foam should be discharged to the destination socket before devices are removed.

INSIDE THE AD206

The functional block diagram of the AD206 has been shown. The AD206 employs a double balanced amplitude modulation technique to implement transformer coupling of signals down to dc. The 430 kHz square wave carrier used by the AD206 is generated by an internal oscillator located on the output side of the isolator. This oscillator is powered by the bipolar 15 V dc supply.

The input port of the AD206 contains an uncommitted input op amp, a modulator and an isolated power supply. The uncommitted input amplifier may be used to supply gain or to buffer the input signals. The primary windings of the power transformer T2 are driven by the 430 kHz square wave while the secondary, in conjunction with a rectifier network, supplies isolated power to the modulator, input op amp and any external load.

A full wave modulator translates the input signal to the carrier frequency which is then transmitted across the signal transformer T1. The synchronous demodulator on the output port extracts the input signal from the carrier. This signal is then passed through a Bessel response low pass filter to an output buffer and is then made available at the output signal terminals.

PERFORMANCE CHARACTERISTICS

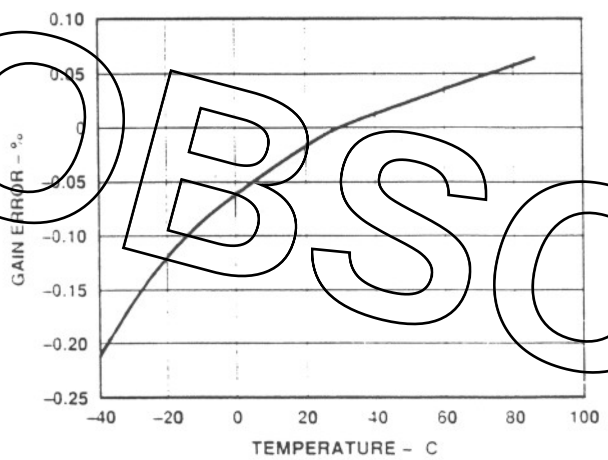


Figure 1. Gain Error vs. Temperature

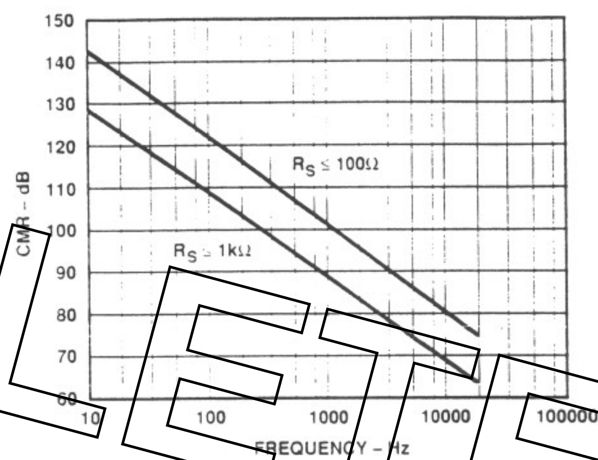


Figure 3. Typical Common-Mode Rejection (dB) vs. Common-Mode Signal Frequency (Hz) and Source Impedance Imbalance (Ω) for the 10 Hz to 20 kHz Frequency Range and with a Gain of 1

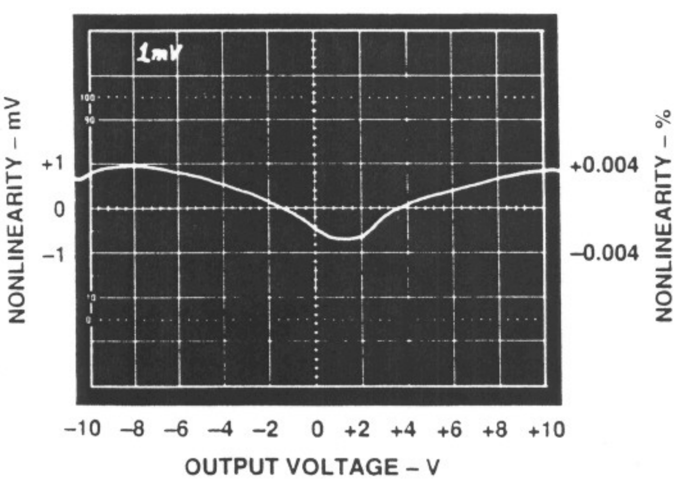


Figure 2. Gain Nonlinearity Error (% of Output Span and mV) vs. Output Voltage Swing for a Gain of 1

Nonlinearity does not change with temperature over the −40°C to +85°C range and is not dependent on the gain setting for gains in the rated 1 V/V to 10 V/V range.

To achieve the optimal common-mode rejection of unwanted signals, it is strongly recommended that the source impedance imbalance be kept as low as possible and that the input circuitry be carefully laid out so as to avoid adding excessive stray capacitances at the isolator's input terminals.

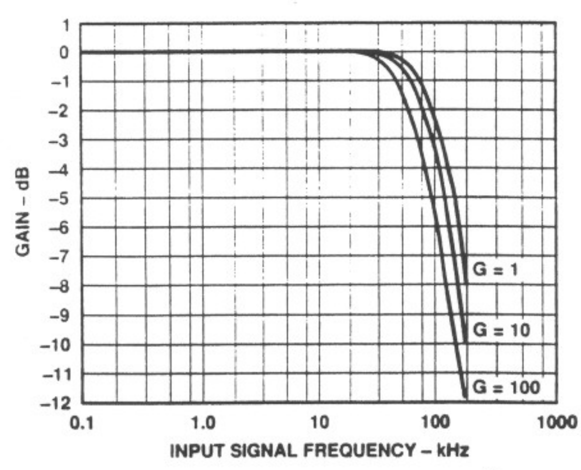


Figure 4. Normalized Gain (dB) as a Function of Input Signal Frequencies (kHz) in the 100 Hz to 150 kHz Range

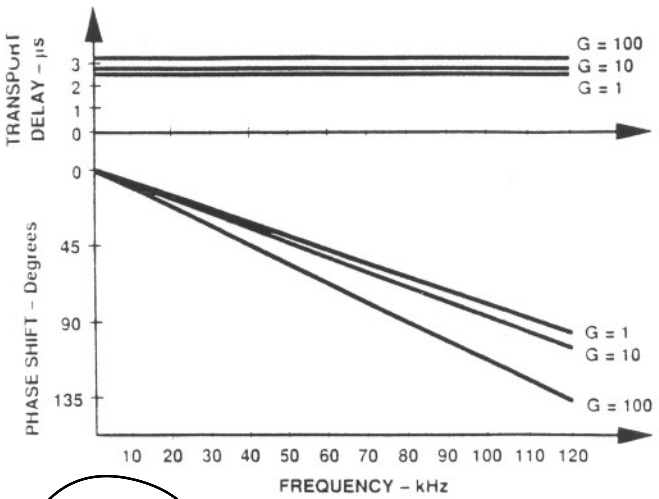
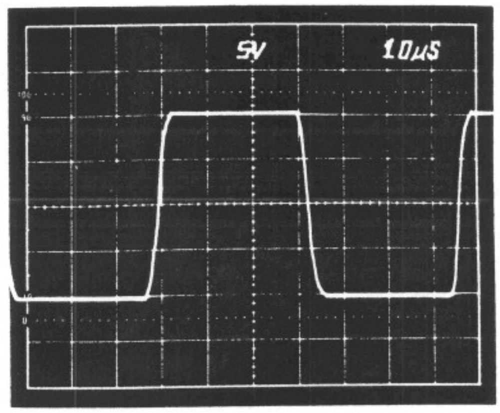


Figure 5. Phase Shift (°) and Transport Delay (μs) vs. Input Signal Frequencies (kHz) in the 10 Hz to 150 kHz Range



±10V, 15kHz STEP INPUT

Figure 7. Output Response of the AD206 to a + and – Full-Scale Step at the Isolator's Input, with a Gain of 1 (R_L = 2kΩ)

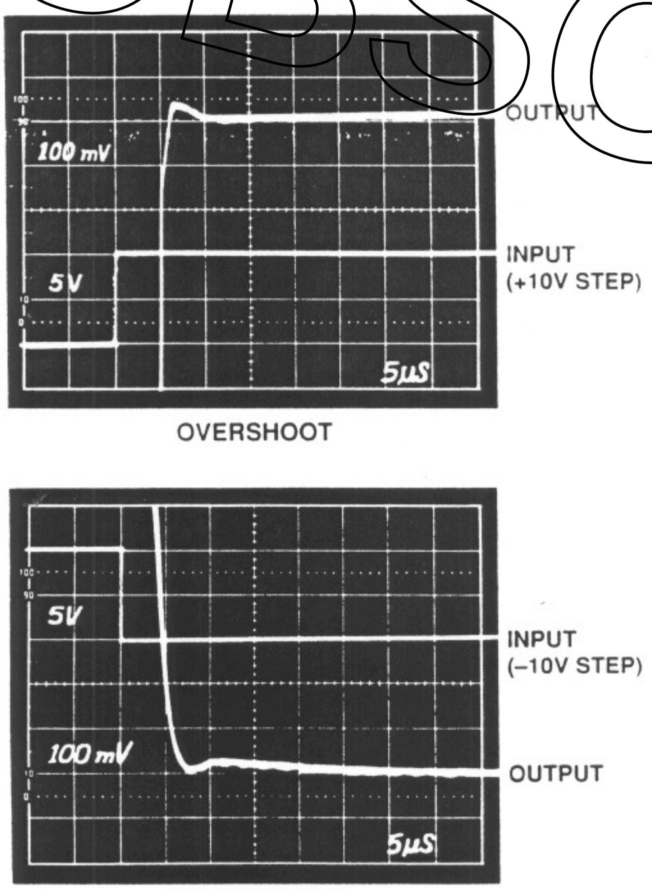


Figure 6. Overshoot/Undershoot Characteristics of the AD206 to a Full-Scale Step at the Isolator's Input and with a Gain of 1 (R_L = 2 kΩ)

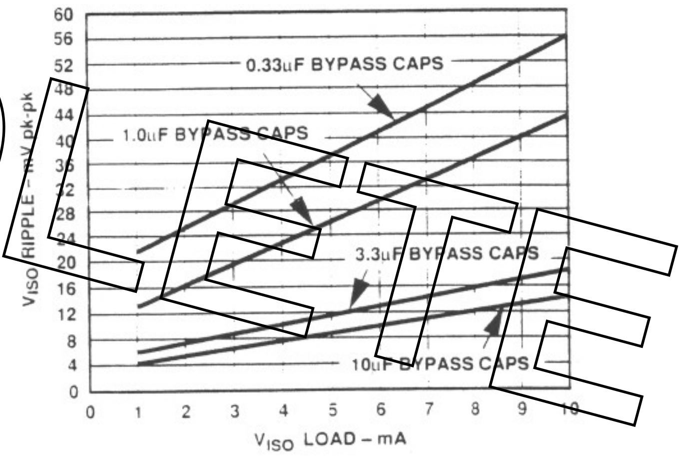


Figure 8. Isolated Power Supply Ripple (mV pk–pk) vs. Load (mA) and Bypass Capacitance (μF)

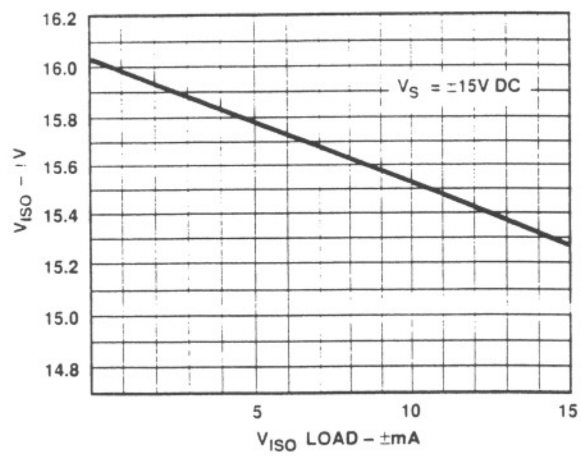


Figure 9. Isolated Power Supply Voltage (V DC) vs. Isolated Power Supply Load (mA)

To avoid increasing the sensitivity of the gain and offset specifications to the supply voltage and isolated load, it is recommended that the isolated power supply load not exceed ±10 mA.

ISOLATION TESTING

As an added assurance of high performance reliability the isolation rating of each AD206 is 100% tested, in production, employing partial discharge or corona techniques. The barrier integrity for each AD206 is verified by using an applied test voltage that is 120% of the continuous isolation rating.

POWERING THE AD206

The AD206 is powered by a bipolar ±15 V dc power supply connected as shown in Figure 10. External bypass capacitors should be provided in the bused applications. Note that a small signal related current (50 μA/V_{OUTPUT}) will flow out of the OUT LO pin (Pin 37). The OUT LO terminals should therefore be bused together and referenced at a single "Analog Star Ground" to the ±15 V dc supply common as illustrated in Figure 10.

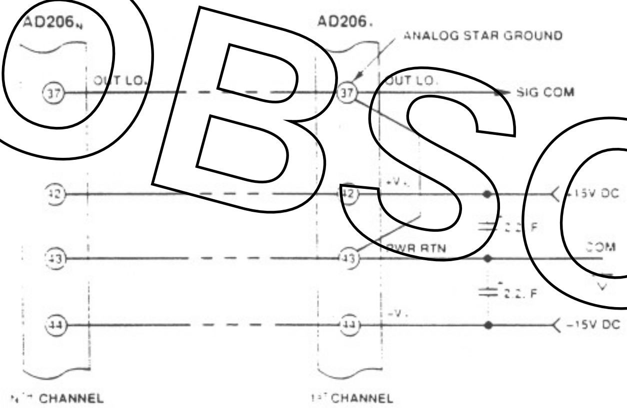


Figure 10. Powering the AD206

Power Supply Voltage Considerations. The rated performance of the AD206 will remain unaffected for power supply voltages in the ±14.5 V dc to ±16.5 V dc range. Voltages below ±14.25 V dc may cause the AD206 to cease operating properly.

Note: Power supply voltages greater than 17.5 V dc may damage the internal components of the AD206 and consequently should not be used.

USING THE AD206

Unity Gain Input Configuration. The basic unity gain configuration for input signals of up to ±10 V is shown in Figure 11.

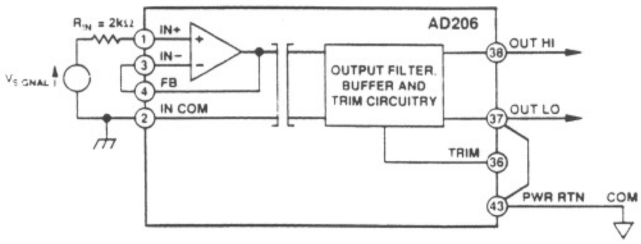


Figure 11. Basic Unity Gain Configuration

Noninverting Input Configuration for a Gain Greater Than 1 (G>1). When input signal levels must be amplified and isolated, Figure 12 shows how to get a gain greater than 1 while continuing to preserve a very high input impedance.

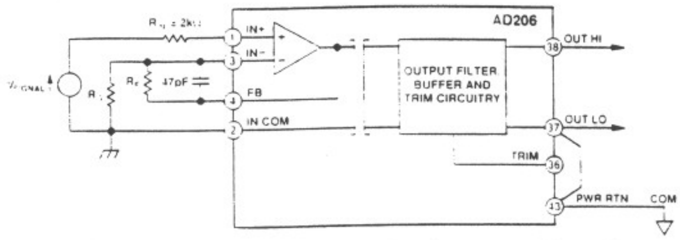


Figure 12. Noninverting Input Configuration for a Gain Greater than 1

In this circuit, the gain equation may be written as:

$$V_O = (1 + R_F/R_G) \times V_{SIG}$$

where:

V_O = Output Voltage (V),
V_{SIG} = Input Signal Voltage (V),
R_F = Feedback Resistor Value (Ω),
R_G = Gain Resistor Value (Ω).

The values for the resistors R_F and R_G should be chosen subject to the following constraints:

- The total impedance of the gain network should be no greater than 10 kΩ.
- The current drawn in the feedback resistor (R_F) is no greater than 1 mA at ±10 V. Note that for each mA drawn by the feedback resistor, the isolated power supply drive capability will decrease by 1 mA.
- The feedback (R_F) and gain resistor (R_G) result in the desired amplifier gain.

It is recommended that the feedback resistor (R_F) is bypassed with a 47 pF capacitor (C_F).

Note on the input resistor (R_{IN}): The 2 kΩ resistor placed in series with the input signal source and the IN− terminal, designated as R_{IN} in Figures 11 and 12, is recommended so as to limit the current seen at the input terminals of the AD206 to 5.0 mA when the AD206 is not powered.

Compensating the Uncommitted Input Op Amp. The open-loop gain and phase versus frequency for the uncommitted input op amp are given in Figure 13. These curves can be used to determine the appropriate values for the feedback resistor and compensation capacitor in order to ensure frequency stability when reactive or nonlinear components are used in conjunction with the uncommitted input op amp.

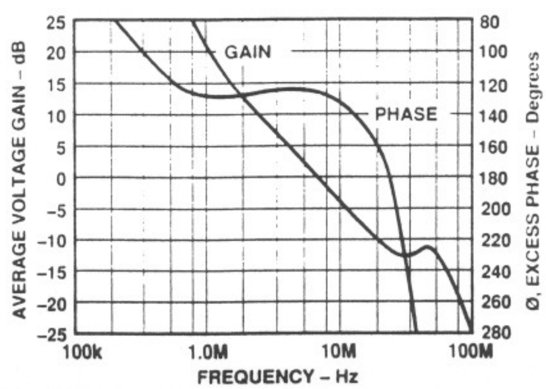


Figure 13. Open-Loop Gain and Phase Response for the Uncommitted Input Op Amp of the AD206

Inverting, Summing or Current Input Configuration. Figure 14 shows how the AD206 can accommodate current inputs or sum currents or voltages.

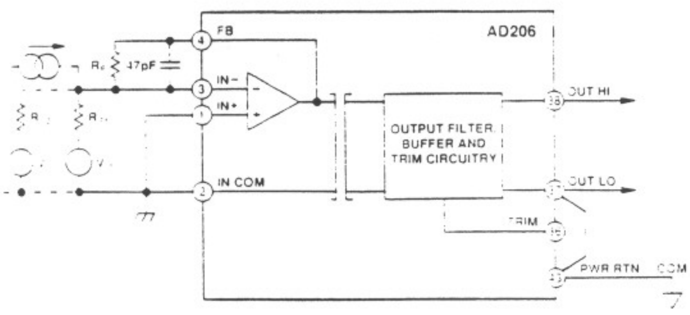


Figure 14. Summing or Current Input Configuration

In this circuit the output voltage equation can be written as:

$$V_O = -R_F \left(I_S + V_{S1}/R_{S1} + V_{S2}/R_{S2} + \ldots \right)$$

where:

V_O = Output Voltage (V).
V_{S1} = Voltage of Input Signal 1 (V).
V_{S2} = Voltage of Input Signal 2 (V).
I_S = Input Current Source (A).
R_F = Feedback Resistor Value (Ω) (10 kΩ, typ).
R_{S1} = Source Resistance Associated with Input Signal 1 (Ω).
R_{S2} = Source Resistance Associated with Input Signal 2 (Ω).

The circuit of Figure 14 can also be used when the input signal is larger than the ±10 V input range of the isolator. For example, suppose that in Figure 14 only V_{S1}, R_{S1} and R_F are connected to the feedback, input and common terminals as shown by the solid lines in Figure 14. Now, a V_{S1} with a ±50 V span can be accommodated with R_F = 10 kΩ and a total R_{S1} = 50 kΩ.

GAIN AND OFFSET ADJUSTMENTS

General Comments. The AD206 features a TRIM pin on the output stage of the isolator. This pin is to be used with user-supplied external circuitry to adjust the output offset of the AD206. When gain and offset adjustments are required, the actual compensation circuit ultimately utilized will depend on:

- The input configuration mode of the isolation amplifier (i.e., noninverting or inverting).
- The placement of the adjusting potentiometer (i.e., on the isolator's input or output side).

As a general rule:

- Gain Adjustments are most easily accomplished as part of the gain-setting resistor network at the isolator's input side.
- To ensure the highest degree of stability in the gain adjustment, the adjusting potentiometers should be located as close as possible to the isolator's front-end and its impedance should be kept low. Adjustment ranges should also be kept to a minimum since their resolution and stability is dependent on the actual trim potentiometers used.
- Output side adjustments may be necessary under the conditions where adjusting potentiometers placed on the input side would present a hazard to the user due to the presence of high common-mode voltages during the adjustment procedure.
- It is recommended that the offset is adjusted prior to the gain adjustment.

Input Gain Adjustments for the Noninverting Mode of Operation. Figure 15 shows the suggested gain adjustment circuit. Note that the gain adjustment potentiometer R_P is incorporated into the gain-setting resistor network at the isolator's input.

For a ±1% trim range (R_P = 1 kΩ), let $R_G = 0.02 \dfrac{R_G \times R_F}{R_G - R_F}$.

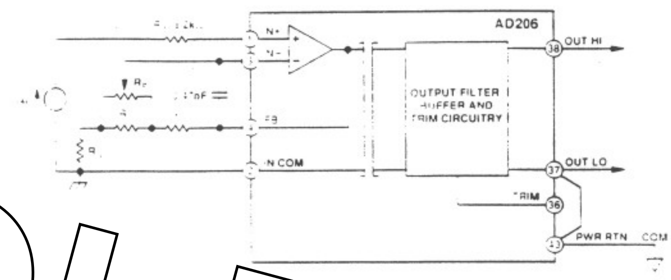


Figure 15. Input Gain Adjustment Circuit for the Noninverting Mode of Operation

Input Gain Adjustments for the Inverting Mode of Operation. Figure 16 shows the suggested gain adjustment circuit. In this circuit, the gain adjustment is made in the feedback loop using potentiometer R_P. The adjustments will be effective for all gains in the 1 to 10 range.

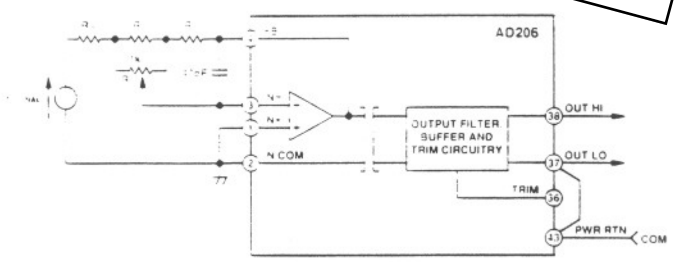


Figure 16. Input Gain Adjustment Circuit for the Inverting Mode of Operation

For an approximate ±1% gain trim range, let

$$R_X = \frac{R_{IN} \times R_F}{R_{IN} - R_F}$$

and select

$$R_C = 0.02 \times R_{IN}$$

while

$$R_F \leq 10\ k\Omega$$

$$C_F = 47\ pF$$

R_F and R_{IN} are selected for a good temperature coefficient match.

Output Offset Adjustments. Figure 17 illustrates one method of adjusting the output offset voltage. Since the AD206 exhibits a nominal output offset of −35 mV, the circuit shown in Figure 17 was chosen to yield an offset correction of from 0 to −73 mV for a total output offset range of from approximately −35 mV to −38 mV.

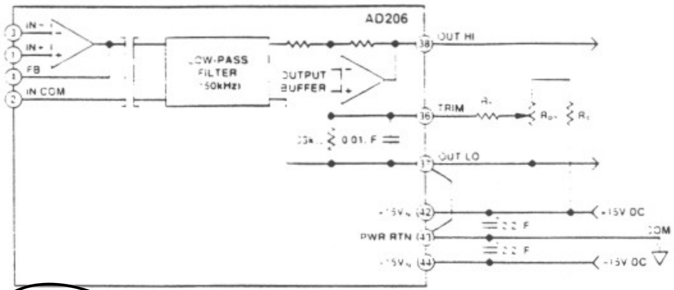


Figure 17. Output Offset Adjustment Circuit

Output Gain Adjustments. Since the output amplifier stage of the AD206 is fixed at unity, any desired output gain adjustments can only be made in a subsequent stage.

USING ISOLATED POWER

The AD206 provides ±15 V dc @ ±10 mA power outputs referred to the input common. These may be used to power various accessory circuits which must operate at the input common-mode level including input adjustment circuits, references, op amps, signal conditioners or remote transducers. Figure 18 shows the recommended connections from the isolated power supplies.

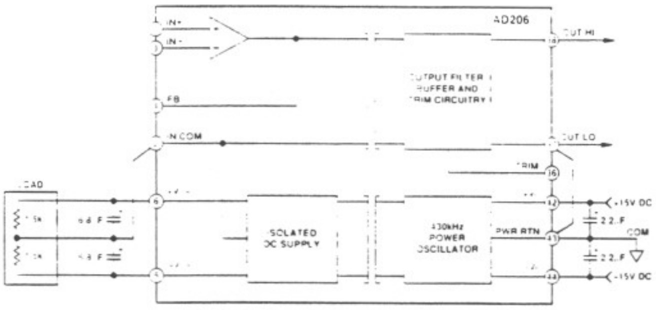


Figure 18. Using the Isolated Power Supplies

The current delivered by the isolated supplies may be increased to ±15 mA if the input dc supply voltage is increased beyond ±15 V dc.

CAUTION: The AD206 design does not provide short circuit protection of its isolated power supply. A current limiting resistor may be placed in series with the isolated power terminals and the load in order to protect the supply against inadvertent shorts.

PCB LAYOUT FOR MULTICHANNEL APPLICATIONS

The pinout of the AD206 has been designed to facilitate high channel density applications. Figure 19a shows the recommended printed circuit board (PCB) layout for the simple unity gain configuration. When gain setting resistors are present, 0.325" channel centers can still be achieved as shown in Figure 19b.

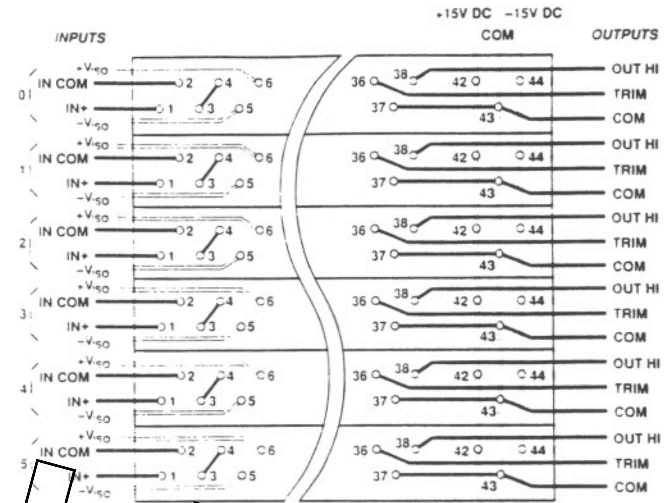


Figure 19a. PCB Layout for Multichannel, Unity Gain Applications

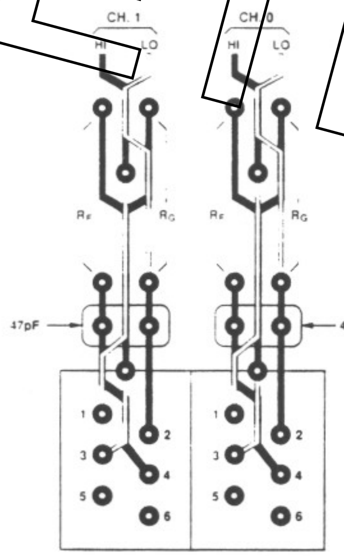


Figure 19b. PCB Layout for Multichannel Applications with Gain Required on the AD206s

APPLICATION EXAMPLES

Motor Control. Figure 20 shows an AD206 used in a dc motor controller application. The excellent phase characteristics and wide bandwidth of the AD206 are ideal for this type of application.

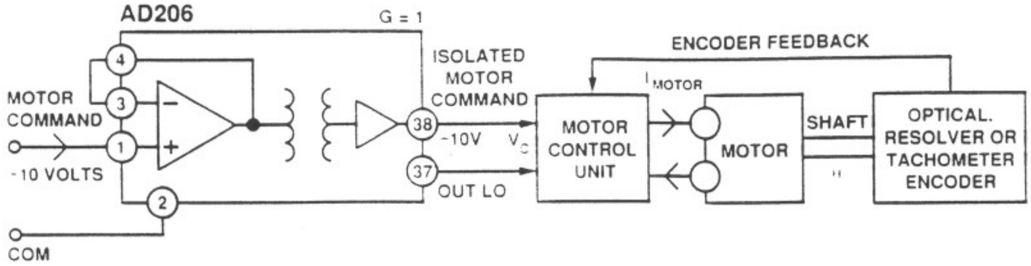


Figure 20. Using the AD206 in a Motor Control Application

Multichannel Data Acquisition

Figure 21 shows the AD206 in a multichannel data acquisition application. Its wide bandwidth, fast slew and settling characteristics are useful in this type of application. The AD206 can be used to solve the problem of low level signal measurement over long distances – extracting the signal, rejecting common-mode noise and protecting against accidental shorts.

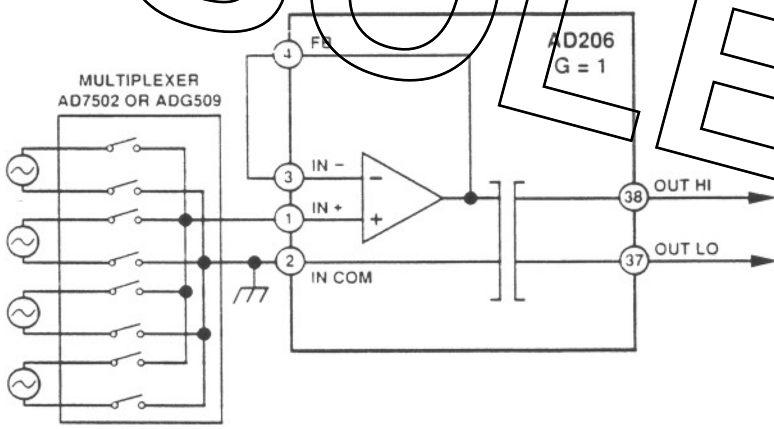


Figure 21. Using the AD206 in Multichannel Data Acquisition Applications

AC Transducer Applications

In applications, such as vibration analysis, where the user must acquire and process the spectral content of a sensor's signal rather than its "dc" level the wideband characteristics of the AD206 will prove to be most useful. Key specifications for ac transducer applications include bandwidth, slew rate and harmonic distortion. Since the transducer may be mechanically bonded or welded to the object under test, isolation will typically be required to eliminate ground loops as well as to protect the electronics used in the data acquisition system. Figure 22 shows an isolated strain gage circuit employing the AD206 isolation amplifier and a 13 MHz operational amplifier.

To alleviate the need for an instrumentation amplifier, the bridge is powered by a bipolar excitation source. Under this approach the common-mode voltage will be $\pm V_{SPAN}$ rather than the $V_{EXC}/2$ that would be achieved with a unipolar excitation source and Wheatstone bridge configuration. A difference in common-mode voltages of typically only a few millivolts.

Using two strain gages with a gage factor of 3 mV/V and a ±1.2 V excitation signal, a ±6.6 mV output signal will result. A gain setting of 454 will scale this low-level signal to ±3 V, which can then be digitized by a high-speed, 100 kHz sampling, ADC such as the AD7870.

The low voltage excitation is used to permit the front-end circuitry to be powered from the isolated power supplies of the AD206, which can supply up to ±10 mA of isolated power at ±15 V. The bridge draws only 3.5 mA, leaving sufficient current to power the micro-power dual BiFET (400 μA quiescent current) and the high speed AD744 BiFET amplifier (4 mA quiescent current).

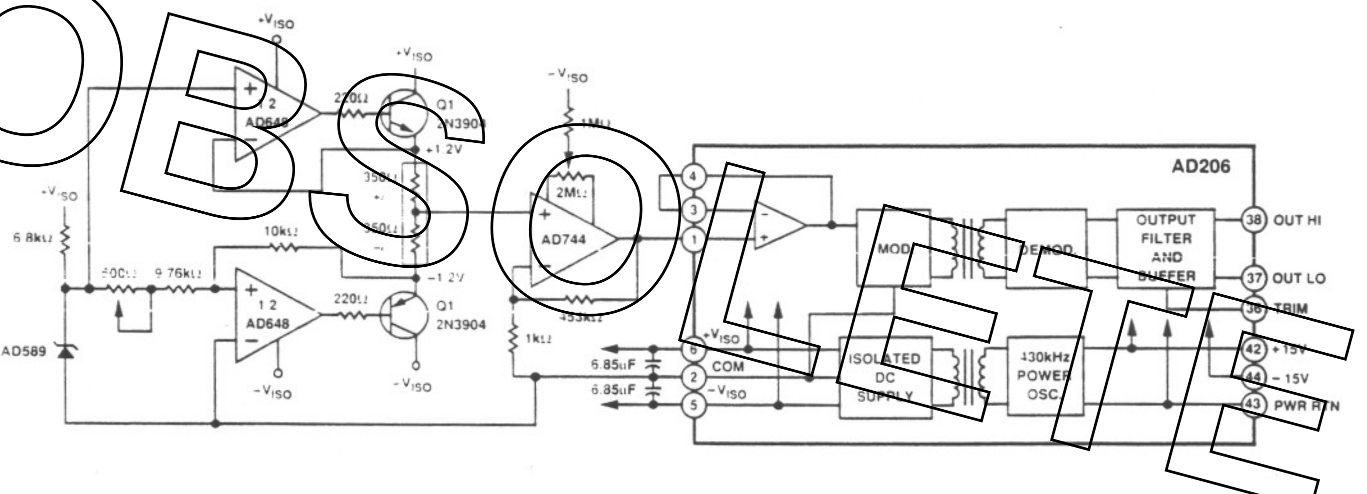


Figure 22. A Strain Gage Signal Conditioning Circuit Using the AD206 Isolation Amplifier

SELECTION GUIDE FOR ANALOG DEVICES' FAMILY OF ISOLATION AMPLIFIERS

	Consider the: If You Need:	AD202	AD203	AD204	AD206	AD208	AD210	284J
General	Isolator for Multichannel Applications			Yes	Yes	Yes		
	Lowest Cost Isolator			Yes				
	3-Port Isolation						Yes	
	Rugged, Military Temperature Range Isolator		Yes					
	Low Offset, mV Input Isolator					Yes		
	Wide Bandwidth				Yes			
Gain	High Gain Capabilities (>500 V/V)	1–100 V/V	1–100 V/V	1–100 V/V	1–10 V/V	1–1000 V/V	1–100 V/V	1–10 V/V
	Low Gain Error (<2.5%)	±4%	±4%	±4%	±2%	±2.5%	±2%	±2.5%
	Low Nonlinearity (<±0.015%)	±0.025%	±0.025%	±0.025%	±0.015%	±0.015%[1]	±0.012%	±0.05%
	Low Gain Temp. Co. (<25 ppm/°C)	45 ppm/°C	60 ppm/°C[2]	45 ppm/°C	55 ppm/°C	20 ppm/°C	25 ppm/°C	75 ppm/°C[2]
Isolation	High CMV Rating (>2.5 kV rms, Continuous)	1.5 kV rms[3]	1.5 kV rms	1.5 kV rms	1.5 kV rms	1.5 kV rms[1]	2.5 kV rms	3.5 kV rms
	High CMR @ 60 Hz, (>104 dB, All Conditions)	100 dB	90 dB	104 dB	105 dB	100 dB	120 dB	110 dB
	Low Leakage Current (<2 μA rms, 240 V rms, 60 Hz)	2 μA rms	4 μA rms	2 μA rms	2 μA rms	2 μA rms	2 μA rms	2 μA rms[4]
Speed	100 kHz Full Power Bandwidth				Yes			
	20 kHz Full Power Bandwidth				Yes		Yes	
	10 kHz Full Power Bandwidth		Yes		Yes		Yes	
	5 kHz Full Power Bandwidth	2 kHz	Yes	Yes	Yes	0.4 to 4 kHz	Yes	700 Hz
	Fast Settling Time (<150 μs)	1 ms	150 μs	1 ms	12 μs	2 ms	150 μs	
	Fast Slew Rate (>1V/μs)		0.5 V/μs		6 V/μs	0.1 V/μs	1 V/μs	25 mV/μs
Offset	Low Input Offset Drift (<5 μV/°C)	±10 μV/°C	±6 μV/°C	±10 μV/°C	±15 μV/°C	±1.5 μV/°C	±10 μV/°C	±20 μV/°C
	Low Output Offset Drift (<20 μV/°C)	±10 μV/°C	±100 μV/°C	±10 μV/°C	±65 μV/°C	±20 μV/°C	±30 μV/°C	±150 μV/°C
Rated Output	±10 V Differential Output	±5 V	±10 V	±5 V	±10 V	±5 V	±10 V	±5 V
	Low Output Impedance (<1 Ω)	7 kΩ	0.2 Ω	3 kΩ	1 Ω	3 kΩ	1 Ω	1 kΩ
Isolated Power Supply	Isolated Front End Power (>75 mW)	6 mW	150 mW	37.5 mW	300 mW	75 mW	150 mW	85 mW
Input Power Supply	Isolator Powered by a DC Supply	+15 V dc	+15 V dc	15 V p-p @ 25 kHz	+15 V dc	15 V p-p @ 25 kHz	+15 V dc	+15 V dc
Rated Performance Temperature	−55°C to +125°C, Rated Range		Yes					
	−40°C to +85°C, Rated Range				Yes	Yes		
	−25°C to +85°C, Rated Range						Yes	
	0 to +70°C, Rated Range[5]	Yes		Yes				Yes
Packaging	Small Size (0.325 in³ typ)	SIP Pkg.	1.021 in³	SIP Pkg.	0.676 in³	SIP Pkg	0.735 in³	1.395 in³
	SIP Package	Yes		Yes	Yes	Yes		
	DIP Package	Yes	Yes	Yes			Yes	Yes

NOTES

All performance specification numbers apply for G = 1 V/V and 0 to +70°C unless noted otherwise. Quotations for gain error nonlinearity, gain temperature coefficient, CMV rating, offset temperature coefficient **and leakage** current are max numbers; all other are typical. Isolated front end power specifications are for both the + and − terminals.

[1]B grade specification.

[2]Typical specification.

[3]K grade specification.

[4]The 284J leakage applies for 115 V rms.

[5]The AD202, AD204 and AD210 series will operate in the −40°C to +85°C temperature range.

CORRECTIONS TO THE AD206 SPECIFICATIONS

April 11, 1991

DRAFT

Parameter	Present Specification	New Specification
Gain Error	0 to -0.5% (0 to 1.5%, max)	±2%, max
Overshoot	0.5%	1%
Viso, No Load	±15 V	±15 V (-5%, +15%)
Viso Accuracy (No Load)	-5%, +15%	**Deleted**, now specified as part of the Viso, No Load entry.

OBSOLETE