ANALOG DEVICES

Dual, Current Feedback Low Power Op Amp

AD812

FEATURES
Two Video Amplifiers in One 8-Lead SOIC Package
Optimized for Driving Cables in Video Systems
Excellent Video Specifications (R_L = 150 Ω):
- **Gain Flatness 0.1 dB to 40 MHz**
- **0.02% Differential Gain Error**
- **0.02° Differential Phase Error**

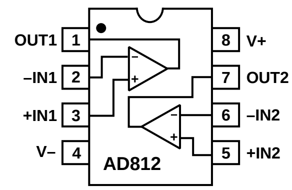
Low Power
- **Operates on Single +3 V Supply**
- **5.5 mA/Amplifier Max Power Supply Current**

High Speed
- **145 MHz Unity Gain Bandwidth (3 dB)**
- **1600 V/µs Slew Rate**

Easy to Use
- **50 mA Output Current**
- **Output Swing to 1 V of Rails (150 Ω Load)**

APPLICATIONS
Video Line Driver
Professional Cameras
Video Switchers
Special Effects

PIN CONFIGURATION
8-Lead Plastic
Mini-DIP and SOIC



PRODUCT DESCRIPTION

The AD812 is a low power, single supply, dual video amplifier. Each of the amplifiers have 50 mA of output current and are optimized for driving one back-terminated video load (150 Ω) each. Each amplifier is a current feedback amplifier and features gain flatness of 0.1 dB to 40 MHz while offering differential gain and phase error of 0.02% and 0.02°. This makes the AD812 ideal for professional video electronics such as cameras and video switchers.

The AD812 offers low power of 4.0 mA per amplifier max (V_S = +5 V) and can run on a single +3 V power supply. The outputs of each amplifier swing to within one volt of either supply rail to easily accommodate video signals of 1 V p-p. Also, at gains of +2 the AD812 can swing 3 V p-p on a single +5 V power supply. All this is offered in a small 8-lead plastic DIP or 8-lead SOIC package. These features make this dual amplifier ideal for portable and battery powered applications where size and power is critical.

The outstanding bandwidth of 145 MHz along with 1600 V/µs of slew rate make the AD812 useful in many general purpose high speed applications where a single +5 V or dual power supplies up to ±15 V are available. The AD812 is available in the industrial temperature range of –40°C to +85°C.

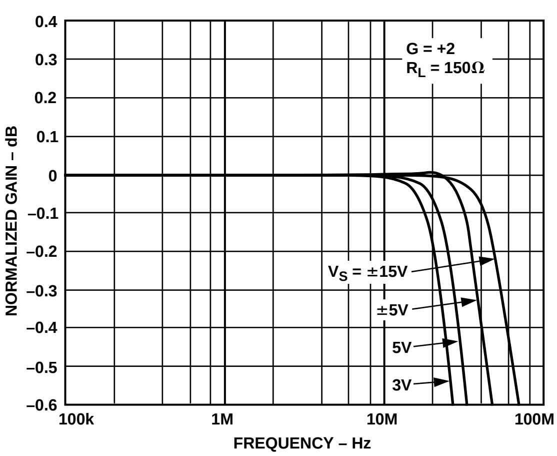


Figure 1. Fine-Scale Gain Flatness vs. Frequency, Gain = +2, R_L = 150 Ω

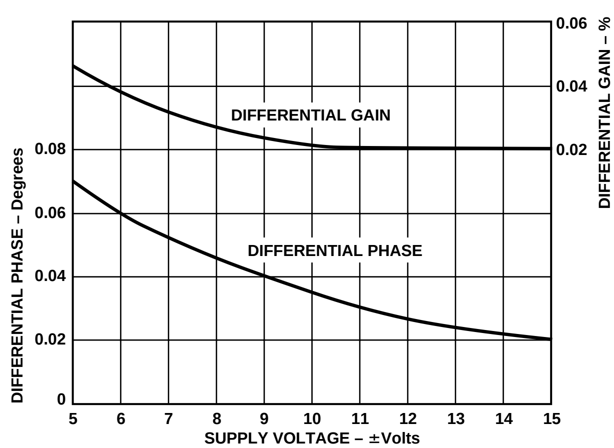


Figure 2. Differential Gain and Phase vs. Supply Voltage, Gain = +2, R_L = 150 Ω

AD812–SPECIFICATIONS

Dual Supply (@ T_A = +25°C, R_L = 150 Ω, unless otherwise noted)

Model	Conditions	V_S	AD812A Min	AD812A Typ	AD812A Max	Units
DYNAMIC PERFORMANCE						
–3 dB Bandwidth	G = +2, No Peaking	±5 V	50	65		MHz
		±15 V	75	100		MHz
	Gain = +1	±15 V	100	145		MHz
Bandwidth for 0.1 dB Flatness	G = +2	±5 V	20	30		MHz
		±15 V	25	40		MHz
Slew Rate[1]	G = +2, R_L = 1 kΩ	±5 V	275	425		V/µs
	20 V Step	±15 V	1400	1600		V/µs
	G = –1, R_L = 1 kΩ	±5 V		250		V/µs
		±15 V		600		V/µs
Settling Time to 0.1%	G = –1, R_L = 1 kΩ					
	V_O = 3 V Step	±5 V		50		ns
	V_O = 10 V Step	±15 V		40		ns
NOISE/HARMONIC PERFORMANCE						
Total Harmonic Distortion	f_C = 1 MHz, R_L = 1 kΩ	±15 V		–90		dBc
Input Voltage Noise	f = 10 kHz	±5 V, ±15 V		3.5		nV/√Hz
Input Current Noise	f = 10 kHz, +In	±5 V, ±15 V		1.5		pA/√Hz
	f = 10 kHz, –In	±5 V, ±15 V		18		pA/√Hz
Differential Gain Error	NTSC, G = +2, R_L = 150 Ω	±5 V		0.05	0.1	%
		±15 V		0.02	0.06	%
Differential Phase Error		±5 V		0.07	0.15	Degrees
		±15 V		0.02	0.06	Degrees
DC PERFORMANCE						
Input Offset Voltage		±5 V, ±15 V		2	5	mV
	T_{MIN}–T_{MAX}				12	mV
Offset Drift		±5 V, ±15 V		15		µV/°C
–Input Bias Current		±5 V, ±15 V		7	25	µA
	T_{MIN}–T_{MAX}				38	µA
+Input Bias Current		±5 V, ±15 V		0.3	1.5	µA
	T_{MIN}–T_{MAX}				2.0	µA
Open-Loop Voltage Gain	V_O = ±2.5 V, R_L = 150 Ω	±5 V	68	76		dB
	T_{MIN}–T_{MAX}		69			dB
	V_O = ±10 V, R_L = 1 kΩ	±15 V	76	82		dB
	T_{MIN}–T_{MAX}		75			dB
Open-Loop Transresistance	V_O = ±2.5 V, R_L = 150 Ω	±5 V	350	550		kΩ
	T_{MIN}–T_{MAX}		270			kΩ
	V_O = ±10 V, R_L = 1 kΩ	±15 V	450	800		kΩ
	T_{MIN}–T_{MAX}		370			kΩ
INPUT CHARACTERISTICS						
Input Resistance	+Input	±15 V		15		MΩ
	–Input			65		Ω
Input Capacitance	+Input			1.7		pF
Input Common Mode		±5 V		4.0		±V
Voltage Range		±15 V		13.5		±V
Common-Mode Rejection Ratio						
Input Offset Voltage	V_{CM} = ±2.5 V	±5 V	51	58		dB
–Input Current				2	3.0	µA/V
+Input Current				0.07	0.15	µA/V
Input Offset Voltage	V_{CM} = ±12 V	±15 V	55	60		dB
–Input Current				1.5	3.3	µA/V
+Input Current				0.05	0.15	µA/V

Model	Conditions	V_S	AD812A Min	Typ	Max	Units
OUTPUT CHARACTERISTICS						
Output Voltage Swing	R_L = 150 Ω, T_{MIN}–T_{MAX}	±5 V	3.5	3.8		±V
	R_L = 1 kΩ, T_{MIN}–T_{MAX}	±15 V	13.6	14.0		±V
Output Current		±5 V	30	40		mA
		±15 V	40	50		mA
Short Circuit Current	G = +2, R_F = 715 Ω	±15 V		100		mA
	V_{IN} = 2 V					
Output Resistance	Open-Loop	±15 V		15		Ω
MATCHING CHARACTERISTICS						
Dynamic						
Crosstalk	G = +2, f = 5 MHz	±5 V, ±15 V		–75		dB
Gain Flatness Match	G = +2, f = 40 MHz	±15 V		0.1		dB
DC						
Input offset Voltage	T_{MIN}–T_{MAX}	±5 V, ±15 V		0.5	3.6	mV
–Input Bias Current	T_{MIN}–T_{MAX}	±5 V, ±15 V		2	25	μA
POWER SUPPLY						
Operating Range			±1.2		±18	V
Quiescent Current	Per Amplifier	±5 V		3.5	4.0	mA
		±15 V		4.5	5.5	mA
	T_{MIN}–T_{MAX}	±15 V			6.0	mA
Power Supply Rejection Ratio						
Input Offset Voltage	V_S = ±1.5 V to ±15 V		70	80		dB
–Input Current				0.3	0.6	μA/V
+Input Current				0.005	0.05	μA/V

NOTES
[1]Slew rate measurement is based on 10% to 90% rise time in the specified closed-loop gain.
Specifications subject to change without notice.

Single Supply (@ T_A = +25°C, R_L = 150 Ω, unless otherwise noted)

Model	Conditions	V_S	AD812A Min	Typ	Max	Units
DYNAMIC PERFORMANCE						
–3 dB Bandwidth	G = +2, No Peaking	+5 V	35	50		MHz
		+3 V	30	40		MHz
Bandwidth for 0.1 dB						
Flatness	G = +2	+5 V	13	20		MHz
		+3 V	10	18		MHz
Slew Rate[1]	G = +2, R_L = 1 kΩ	+5 V		125		V/μs
		+3 V		60		V/μs
NOISE/HARMONIC PERFORMANCE						
Input Voltage Noise	f = 10 kHz	+5 V, +3 V		3.5		nV/√Hz
Input Current Noise	f = 10 kHz, +In	+5 V, +3 V		1.5		pA/√Hz
	f = 10 kHz, –In	+5 V, +3 V		18		pA/√Hz
Differential Gain Error[2]	NTSC, G = +2, R_L = 150 Ω	+5 V		0.07		%
	G = +1	+3 V		0.15		%
Differential Phase Error[2]	G = +2	+5 V		0.06		Degrees
	G = +1	+3 V		0.15		Degrees

AD812–SPECIFICATIONS

Single Supply (Continued)

Model	Conditions	V_S	AD812A Min	Typ	Max	Units
DC PERFORMANCE						
Input Offset Voltage		+5 V, +3 V		1.5	4.5	mV
	$T_{MIN}–T_{MAX}$				7.0	mV
Offset Drift		+5 V, +3 V		7		µV/°C
–Input Bias Current		+5 V, +3 V		2	20	µA
	$T_{MIN}–T_{MAX}$				30	µA
+Input Bias Current		+5 V, +3 V		0.2	1.5	µA
	$T_{MIN}–T_{MAX}$				2.0	µA
Open-Loop Voltage Gain	V_O = +2.5 V p-p	+5 V	67	73		dB
	V_O = +0.7 V p-p	+3 V		70		dB
Open-Loop Transresistance	V_O = +2.5 V p-p	+5 V	250	400		kΩ
	V_O = +0.7 V p-p	+3 V		300		kΩ
INPUT CHARACTERISTICS						
Input Resistance	+Input	+5 V		15		MΩ
	–Input	+5 V		90		Ω
Input Capacitance	+Input			2		pF
Input Common Mode		+5 V	1.0		4.0	V
Voltage Range		+3 V	1.0		2.0	V
Common-Mode Rejection Ratio						
Input Offset Voltage	V_{CM} = 1.25 V to 3.75 V	+5 V	52	55		dB
–Input Current				3	5.5	µA/V
+Input Current				0.1	0.2	µA/V
Input Offset Voltage	V_{CM} = 1 V to 2 V	+3 V		52		dB
–Input Current				3.5		µA/V
+Input Current				0.1		µA/V
OUTPUT CHARACTERISTICS						
Output Voltage Swing p-p	R_L = 1 kΩ, $T_{MIN}–T_{MAX}$	+5 V	3.0	3.2		V p-p
	R_L = 150 Ω, $T_{MIN}–T_{MAX}$	+5 V	2.8	3.1		V p-p
		+3 V	1.0	1.3		V p-p
Output Current		+5 V	20	30		mA
		+3 V	15	25		mA
Short Circuit Current	G = +2, R_F = 715 Ω	+5 V		40		mA
	V_{IN} = 1 V					
MATCHING CHARACTERISTICS						
Dynamic						
Crosstalk	G = +2, f = 5 MHz	+5 V, +3 V		–72		dB
Gain Flatness Match	G = +2, f = 20 MHz	+5 V, +3 V		0.1		dB
DC						
Input offset Voltage	$T_{MIN}–T_{MAX}$	+5 V, +3 V		0.5	3.5	mV
–Input Bias Current	$T_{MIN}–T_{MAX}$	+5 V, +3 V		2	25	µA
POWER SUPPLY						
Operating Range			2.4		36	V
Quiescent Current	Per Amplifier	+5 V		3.2	4.0	mA
		+3 V		3.0	3.5	mA
	$T_{MIN}–T_{MAX}$	+5 V			4.5	mA
Power Supply Rejection Ratio						
Input Offset Voltage	V_S = +3 V to +30 V		70	80		dB
–Input Current				0.3	0.6	µA/V
+Input Current				0.005	0.05	µA/V
TRANSISTOR COUNT				56		

NOTES

[1]Slew rate measurement is based on 10% to 90% rise time in the specified closed-loop gain.

[2]Single supply differential gain and phase are measured with the ac coupled circuit of Figure 53.

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS[1]

Supply Voltage . . . . ±18 V
Internal Power Dissipation[2]
  Plastic (N) . . . . 1.3 Watts
  Small Outline (R) . . . . 0.9 Watts
Input Voltage (Common Mode) . . . . $\pm V_S$
Differential Input Voltage . . . . ±1.2 V
Output Short Circuit Duration
  . . . . Observe Power Derating Curves
Storage Temperature Range N, R . . . . –65°C to +125°C
Operating Temperature Range . . . . –40°C to +85°C
Lead Temperature Range (Soldering, 10 sec) . . . . +300°C

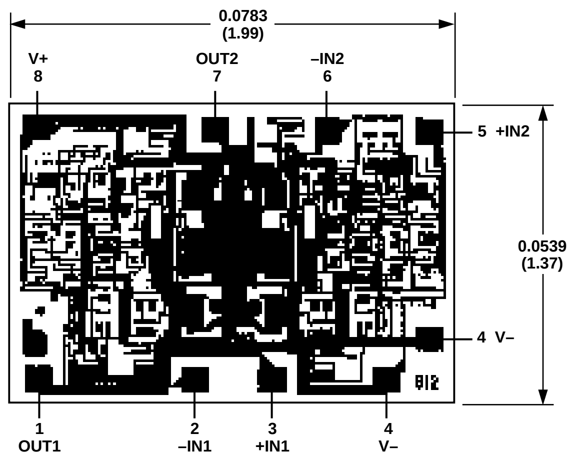
NOTES
[1]Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
[2]Specification is for device in free air: 8-lead plastic package: θ_{JA} = 90°C/Watt; 8-lead SOIC package: θ_{JA} = 150°C/Watt.

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
AD812AN	–40°C to +85°C	8-Lead Plastic DIP	N-8
AD812AR	–40°C to +85°C	8-Lead Plastic SOIC	SO-8
AD812AR-REEL		13" Reel	
AD812AR-REEL7		7" Reel	

METALIZATION PHOTO

Dimensions shown in inches and (mm).



MAXIMUM POWER DISSIPATION

The maximum power that can be safely dissipated by the AD812 is limited by the associated rise in junction temperature. The maximum safe junction temperature for the plastic encapsulated parts is determined by the glass transition temperature of the plastic, about 150°C. Exceeding this limit temporarily may cause a shift in parametric performance due to a change in the stresses exerted on the die by the package. Exceeding a junction temperature of 175°C for an extended period can result in device failure.

While the AD812 is internally short circuit protected, this may not be sufficient to guarantee that the maximum junction temperature (150 degrees) is not exceeded under all conditions. To ensure proper operation, it is important to observe the derating curves.

It must also be noted that in high (noninverting) gain configurations (with low values of gain resistor), a high level of input overdrive can result in a large input error current, which may result in a significant power dissipation in the input stage. This power must be included when computing the junction temperature rise due to total internal power.

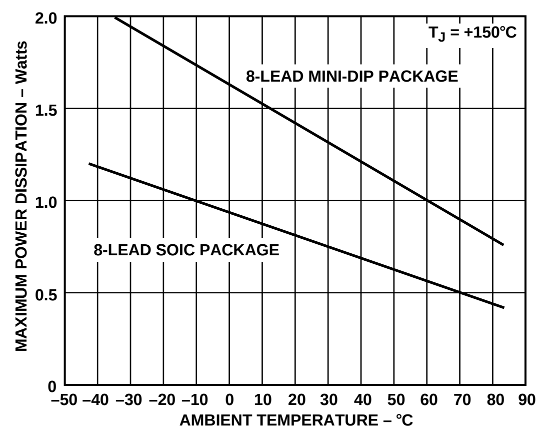


Figure 3. Plot of Maximum Power Dissipation vs. Temperature

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 AD812 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.

WARNING!
ESD SENSITIVE DEVICE

Operation Using a Single Supply

The AD812 will operate with total supply voltages from 36 V down to 2.4 V. With proper biasing (see Figure 53), it can be an outstanding single supply video amplifier. Since the input and output voltage ranges extend to within 1 volt of the supply rails, it will handle a 1.3 V p-p signal on a single 3.3 V supply, or a 3 V p-p signal on a single 5 V supply. The small signal, 0.1 dB bandwidths will exceed 10 MHz in either case, and the large signal bandwidths will exceed 6 MHz.

The capacitively coupled cable driver in Figure 53 will achieve outstanding differential gain and phase errors of 0.07% and 0.06 degrees respectively on a single 5 V supply. Resistor R2, in this circuit, is selected to optimize the differential gain and phase by operating the amplifier in its most linear region. To optimize the circuit for a 3 V supply, a value of 8 kΩ is recommended for R2.

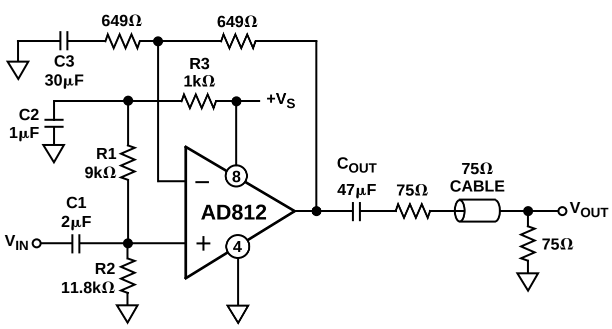


Figure 53. Biasing for Single Supply Operation

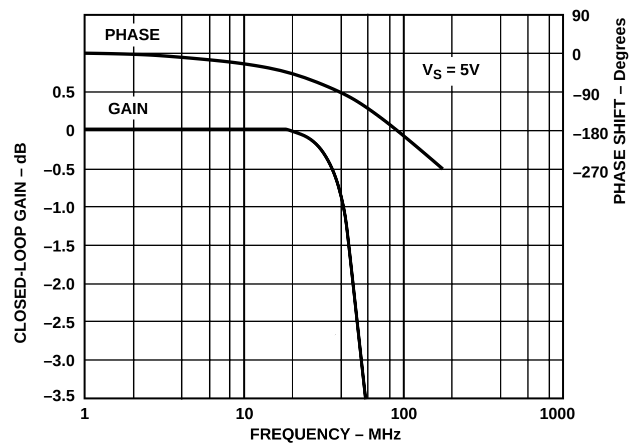


Figure 54. Closed-Loop Gain and Phase vs. Frequency, Circuit of Figure 53

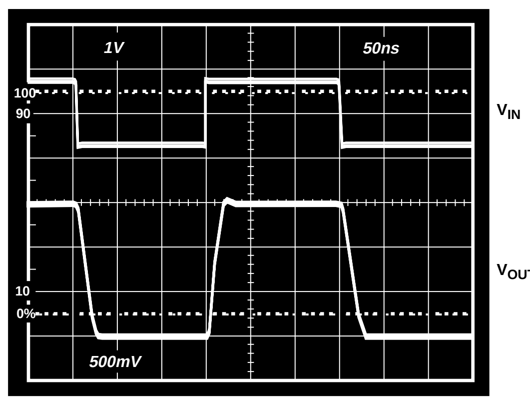
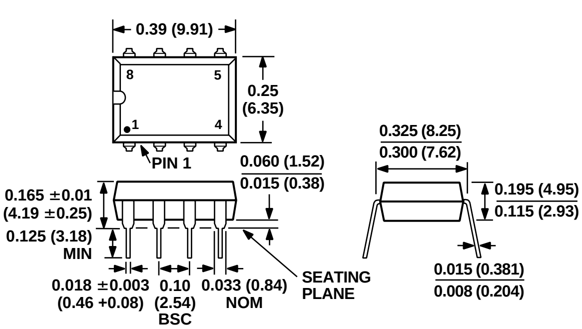


Figure 55. Pulse Response of the Circuit of Figure 53 with V_S = 5 V

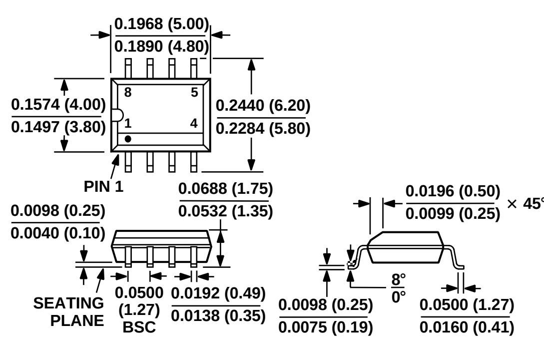
OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).

8-Lead Plastic DIP (N-8)



8-Lead Plastic SOIC (SO-8)



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