

FEATURES

AC PERFORMANCE

500 ns Settling to 0.01% for 10 V Step
 75 V/ μ s Slew Rate
 0.0001% Total Harmonic Distortion (THD)
 13 MHz Gain Bandwidth
 Internal Compensation for Gains of +2 or Greater

DC PERFORMANCE

0.5 mV max Offset Voltage (AD746B)
 10 μ V/ $^{\circ}$ C max Drift (AD746B)
 175 V/mV min Open Loop Gain (AD746B)
 2 μ V p-p Noise, 0.1 Hz to 10 Hz
 Available in Plastic Mini-DIP, Cerdip and Surface Mount Packages
 Available in Tape and Reel in Accordance with EIA-481A Standard
 MIL-STD-883B Processing also Available
 Single Version: AD744

APPLICATIONS

Dual Output Buffers for 12- and 14-Bit DACs
 Input Buffers for Precision ADCs, Wideband Preamplifiers and Low Distortion Audio Circuitry

PRODUCT DESCRIPTION

The AD746 is a dual operational amplifier, consisting of two AD744 BiFET op amps on a single chip. These precision monolithic op amps offer excellent dc characteristics plus rapid settling times, high slew rates and ample bandwidths. In addition, the AD746 provides the close matching ac and dc characteristics inherent to amplifiers sharing the same monolithic die.

The single pole response of the AD746 provides fast settling: 500 ns to 0.01%. This feature, combined with its high dc precision, makes it suitable for use as a buffer amplifier for 12- or 14-bit DACs and ADCs. Furthermore, the AD746's low total harmonic distortion (THD) level of 0.0001% and very close matching ac characteristics make it an ideal amplifier for many demanding audio applications.

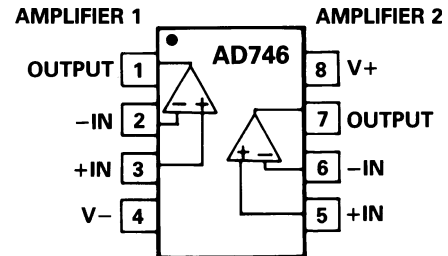
The AD746 is internally compensated for stable operation as a unity gain inverter or as a noninverting amplifier with a gain of 2 or greater. It is available in four performance grades. The AD746J is rated over the commercial temperature range of 0 to +70 $^{\circ}$ C. The AD746A and AD746B are rated over the industrial temperature range of -40 $^{\circ}$ C to +85 $^{\circ}$ C. The AD746S is rated over the military temperature range of -55 $^{\circ}$ C to +125 $^{\circ}$ C and is available processed to MIL-STD-883B, Rev. C.

REV. B

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CONNECTION DIAGRAM

Plastic Mini-DIP (N)
 Cerdip (Q) and
 Plastic SOIC (R) Packages



The AD746 is available in three 8-pin packages: plastic mini DIP, hermetic cerdip and surface mount (SOIC).

PRODUCT HIGHLIGHTS

1. The AD746 offers exceptional dynamic response for high speed data acquisition systems. It settles to 0.01% in 500 ns and has a 100% tested minimum slew rate of 50 V/ μ s (AD746B).
2. Outstanding dc precision is provided by a combination of Analog Devices' advanced processing technology, laser wafer drift trimming and well-matched ion-implanted JFETs. Input offset voltage, input bias current and input offset current are specified in the warmed-up condition and are 100% tested.
3. Differential and multichannel systems will benefit from the AD746's very close matching of ac characteristics. Input offset voltage specs are fully tested and guaranteed to a maximum of 0.5 mV (AD746B).
4. The AD746 has very close, guaranteed matching of input bias current between its two amplifiers.
5. Unity gain stable version AD712 also available.

AD746—SPECIFICATIONS (@ +25°C and ±15 V dc, unless otherwise noted)

Model	Conditions	AD746J/A			AD746B			AD746S			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
INPUT OFFSET VOLTAGE¹											
Initial Offset	T_{MIN} to T_{MAX}		0.3	1.5		0.25	0.5		0.3	1.0	mV
Offset vs. Temperature				12	20		5	10		12	20
vs. Supply ² (PSRR)	T_{MIN} to T_{MAX}		80	95		84	100		80	95	$\mu V/^{\circ}C$
vs. Supply (PSRR)				80						80	
Long Term Stability				15		15				15	$\mu V/month$
INPUT BIAS CURRENT³											
Either Input	$V_{CM} = 0 V$		110	250		110	150		110	250	pA
Either Input @ T_{MAX}	$V_{CM} = 0 V$		2.5/7	5.7/16		7	9.6		113	256	nA
Either Input	$V_{CM} = +10 V$		145	350		145	200		145	350	pA
Offset Current	$V_{CM} = 0 V$		45	125		45	75		45	125	pA
Offset Current @ T_{MAX}	$V_{CM} = 0 V$		1.0/3	2.8/8		3	4.8		45	128	nA
MATCHING CHARACTERISTICS											
Input Offset Voltage	T_{MIN} to T_{MAX}		0.6	1.5		0.3	0.5		0.6	1.0	mV
Input Offset Voltage					2.0		0.7			1.5	2.0
Input Offset Voltage Drift	@ 1 kHz			20		20				20	$\mu V/^{\circ}C$
Input Bias Current		@ 100 kHz		120	125		75			125	pA
Crosstalk			90			90			90		dB
FREQUENCY RESPONSE											
Gain BW, Small Signal	$G = -1$	8	13		9	13		8	13		MHz
Slew Rate, Unity Gain	$G = -1$	45	75		50	75		45	75		V/ μs
Full Power Response	$V_O = 20 V$ p-p		600			600			600		kHz
Settling Time to 0.01% ⁴	$G = 1$		0.5	0.75		0.5	0.75		0.5	0.75	μs
Total Harmonic Distortion	$f = 1 kHz$ $R_1 \geq 2 k\Omega$ $V_O = 3 V$ rms		0.0001			0.0001			0.0001		%
INPUT IMPEDANCE											
Differential			$2.5 \times 10^{11} 5.5$			$2.5 \times 10^{11} 5.5$			$2.5 \times 10^{11} 5.5$		ΩpF
Common Mode			$2.5 \times 10^{11} 5.5$			$2.5 \times 10^{11} 5.5$			$2.5 \times 10^{11} 5.5$		ΩpF
INPUT VOLTAGE RANGE											
Differential ⁵			± 20			± 20			± 20		V
Common-Mode Voltage			+14.5, -11.5			+14.5, -11.5			+14.5, -11.5		V
Over Max Operating Range ⁶		-11		+13	-11		+13	-11		+13	V
Common-Mode Rejection Ratio	$V_{CM} = \pm 10 V$	78	88		82	88		78	88		dB
	T_{MIN} to T_{MAX}	76	84		80	84		76	84		dB
	$V_{CM} = \pm 11 V$	72	84		78	84		72	84		dB
	T_{MIN} to T_{MAX}	70	80		74	80		70	80		dB
INPUT VOLTAGE NOISE											
	0.1 to 10 Hz		2			2			2		μV p-p
	$f = 10 Hz$		45			45			45		nV/\sqrt{Hz}
	$f = 100 Hz$		22			22			22		nV/\sqrt{Hz}
	$f = 1 kHz$		18			18			18		nV/\sqrt{Hz}
	$f = 10 kHz$		16			16			16		nV/\sqrt{Hz}
INPUT CURRENT NOISE											
	$f = 1 kHz$		0.01			0.01			0.01		pA/\sqrt{Hz}
OPEN LOOP GAIN											
	$V_O = \pm 10 V$		150	300		175	300		150	300	V/mV
	$R_1 \geq 2 k\Omega$		75	200		75	200		65	175	V/mV
	T_{MIN} to T_{MAX}										
OUTPUT CHARACTERISTICS											
Voltage	$R_1 \geq 2 k\Omega$	+13, -12.5	+13.9, -13.3		+13, -12.5	+13.9, -13.3		+13, -12.5	+13.9, -13.3		V
	T_{MIN} to T_{MAX}	± 12	+13.8, -13.1		± 12	+13.8, -13.1		± 12	+13.8, -13.1		V
Current	Short Circuit		25			25			25		mA
Max Capacitive Load	Gain = -1		50			50			50		pF
Driving Capability	Gain = -10		500			500			500		pF
POWER SUPPLY											
Rated Performance			± 15			± 15			± 15		V
Operating Range		± 4.5		± 18	± 4.5		± 18	± 4.5		± 18	V
Quiescent Current			7	10		7	8.0		7	10	mA
TEMPERATURE RANGE											
Rated Performance			0 to +70/-40 to +85			-40 to +85			-55 to +125		$^{\circ}C$
PACKAGE OPTIONS											
8-Pin Plastic Mini-DIP (N-8)			AD746JN			AD746BQ			AD746SQ		
8-Pin Cerdip (Q-8)			AD746AQ								
8-Pin Surface Mount (R-8)			AD746JR								
Tape and Reel Chips			AD746JR-REEL						AD746SCHIPS		
TRANSISTOR COUNT											
			54			54			54		

NOTES

- ¹Input Offset Voltage specifications are guaranteed after 5 minutes of operation at $T_A = +25^\circ\text{C}$.
 - ²PSRR test conditions: $+V_S = 15\text{ V}$, $-V_S = -12\text{ V}$ to -18 V and $+V_S = 12\text{ V}$ to 18 V , $-V_S = -15\text{ V}$.
 - ³Bias Current Specifications are guaranteed maximum at either input after 5 minutes of operation at $T_A = +25^\circ\text{C}$. For higher temperature, the current doubles every 10°C .
 - ⁴Gain = -1, $R_I = 2\text{ k}$, $C_I = 10\text{ pF}$.
 - ⁵Defined as voltage between inputs, such that neither exceeds $\pm 10\text{ V}$ from ground.
 - ⁶Typically exceeding -14.1 V negative common-mode voltage on either input results in an output phase reversal.
- Specifications subject to change without notice.

Specifications in **boldface** are tested on all production units at final electrical test. Results from those tests are used to calculate outgoing quality levels. All min and max specifications are guaranteed, although only those shown in **boldface** are tested on all production units.

ABSOLUTE MAXIMUM RATINGS¹

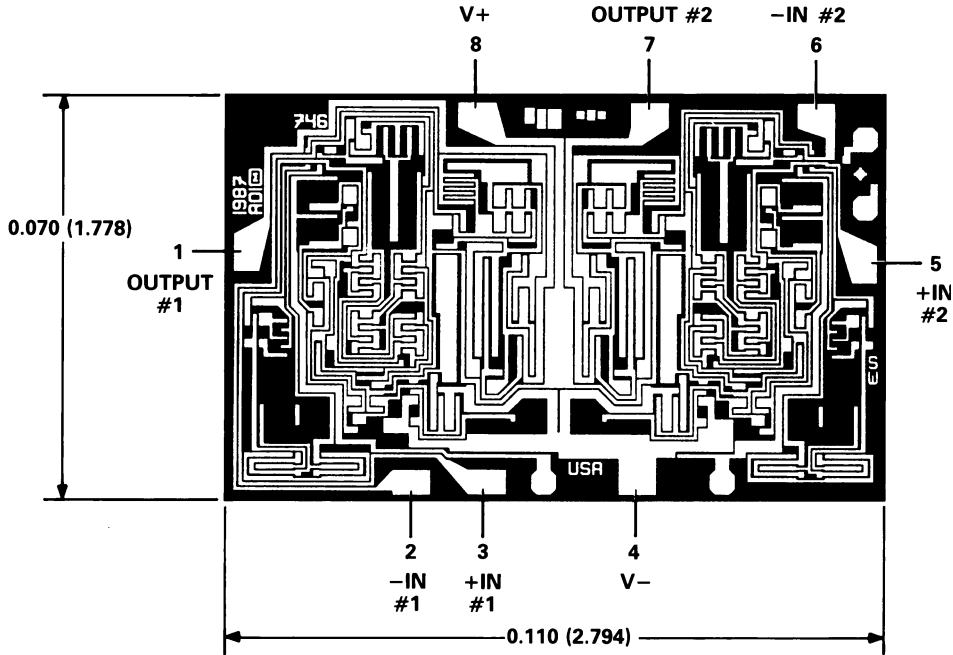
Supply Voltage	$\pm 18\text{ V}$
Internal Power Dissipation ²	500 mW
Input Voltage	$\pm V_S$
Output Short Circuit Duration (For One Amplifier)	Indefinite
Differential Input Voltage	$+V_S$ and $-V_S$
Storage Temperature Range (Q)	-65°C to $+150^\circ\text{C}$
Storage Temperature Range (N, R)	-65°C to $+125^\circ\text{C}$
Operating Temperature Range	
AD746J	0°C to $+70^\circ\text{C}$
AD746A/B	-40°C to $+85^\circ\text{C}$
AD746S	-55°C to $+125^\circ\text{C}$

Lead Temperature Range (Soldering 60 seconds)	$+300^\circ\text{C}$
ESD Rating	

- NOTES**
- ¹Stresses 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.
 - ²8-Pin Plastic Package: $\theta_{JA} = 100^\circ\text{C/Watt}$, $\theta_{JC} = 50^\circ\text{C/Watt}$
 - 8-Pin Cerdip Package: $\theta_{JA} = 110^\circ\text{C/Watt}$, $\theta_{JC} = 30^\circ\text{C/Watt}$
 - 8-Pin Small Outline Package: $\theta_{JA} = 160^\circ\text{C/Watt}$, $\theta_{JC} = 42^\circ\text{C/Watt}$

METALIZATION PHOTOGRAPH

Contact factory for latest dimensions.
Dimensions shown in inches and (mm).



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 AD746 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.



AD746—Typical Characteristics

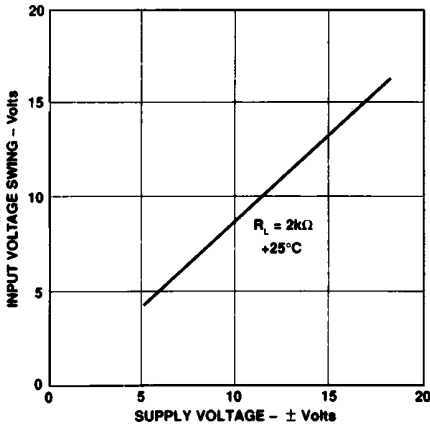


Figure 1. Input Voltage Swing vs. Supply Voltage

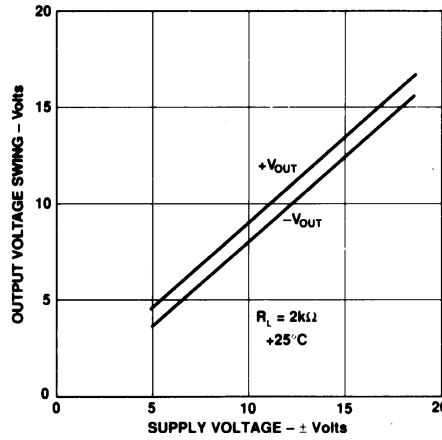


Figure 2. Output Voltage Swing vs. Supply Voltage

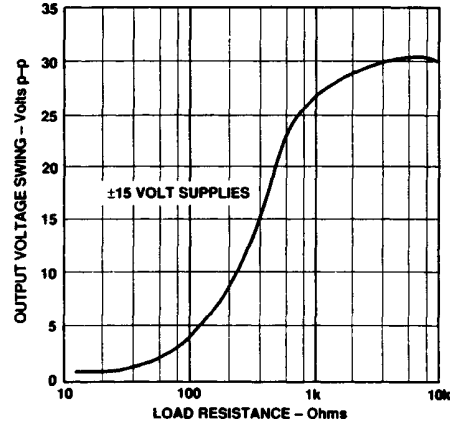


Figure 3. Output Voltage Swing vs. Load Resistance

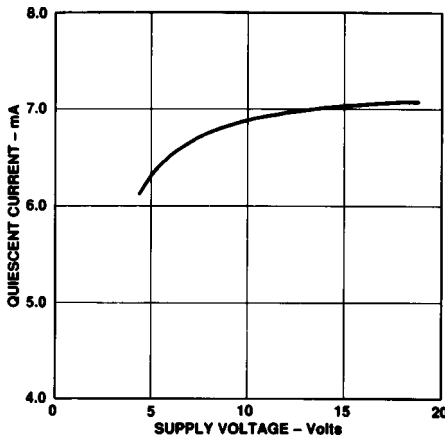


Figure 4. Quiescent Current vs. Supply Voltage

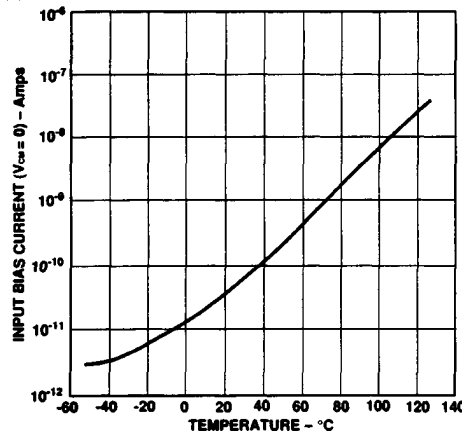


Figure 5. Input Bias Current vs. Temperature

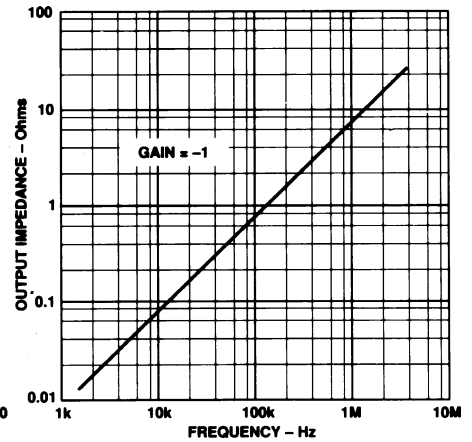


Figure 6. Output Impedance vs. Frequency

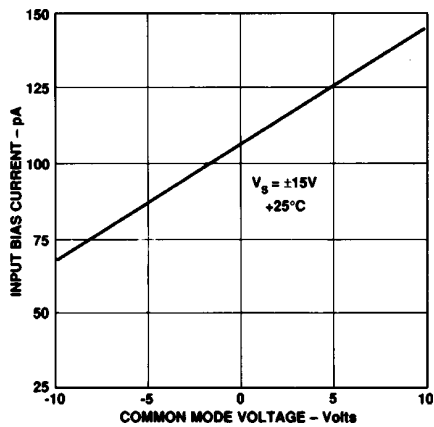


Figure 7. Input Bias Current vs. Common Mode Voltage

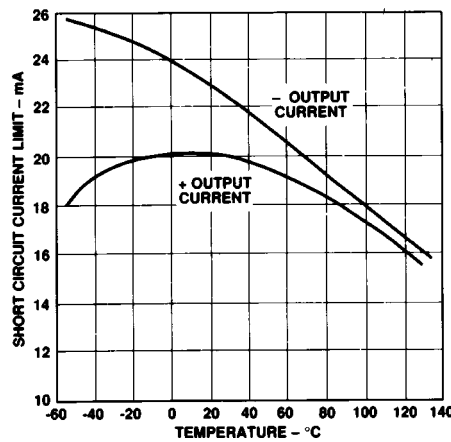


Figure 8. Short Circuit Current Limit vs. Temperature

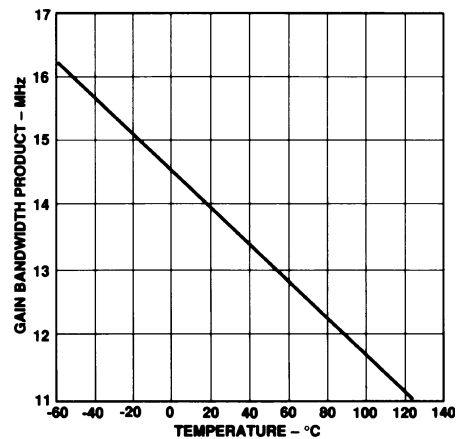


Figure 9. Gain Bandwidth Product vs. Temperature

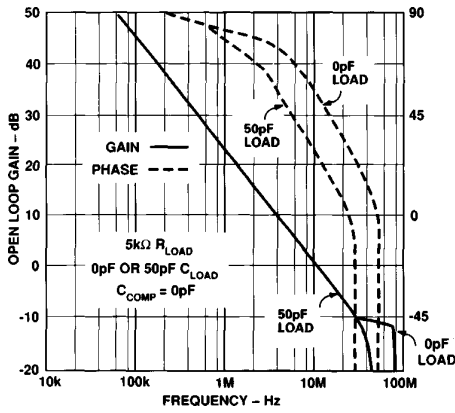


Figure 10. Open Loop Gain and Phase Margin vs. Frequency

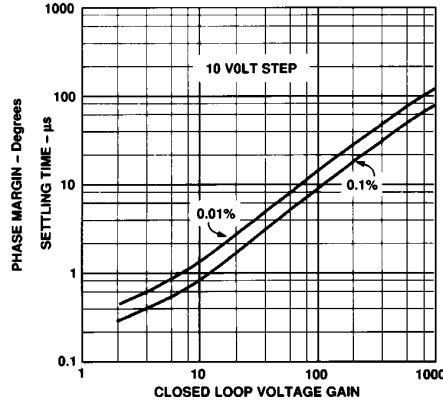


Figure 11. Settling Time vs. Closed Loop Voltage Gain

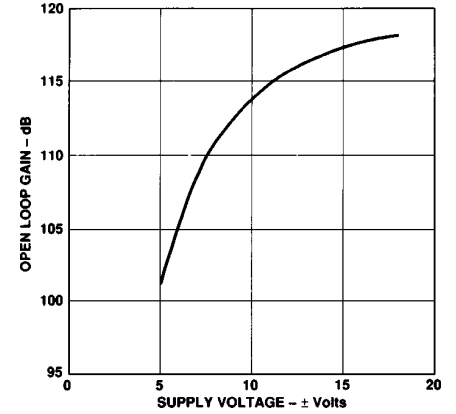


Figure 12. Open Loop Gain vs. Supply Voltage

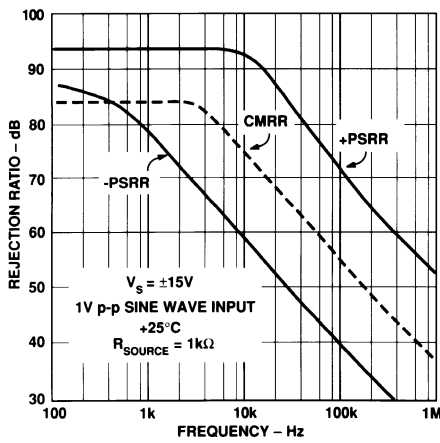


Figure 13. Common-Mode and Power Supply Rejection vs. Frequency

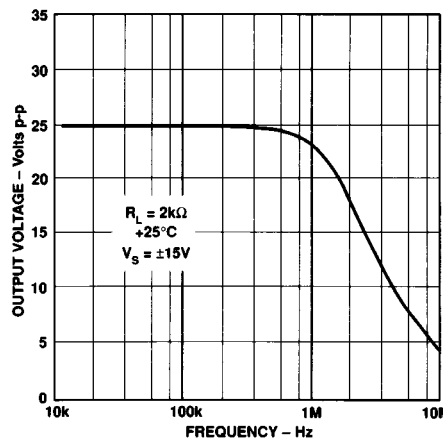


Figure 14. Large Signal Frequency Response

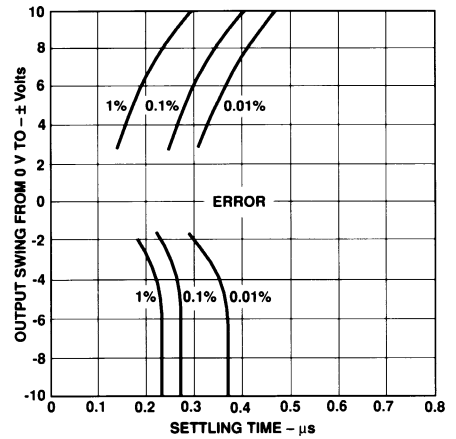


Figure 15. Output Swing and Error vs. Settling Time

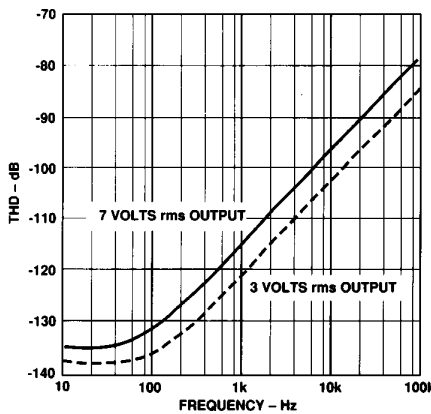


Figure 16. Total Harmonic Distortion vs. Frequency Using Circuit of Figure 19

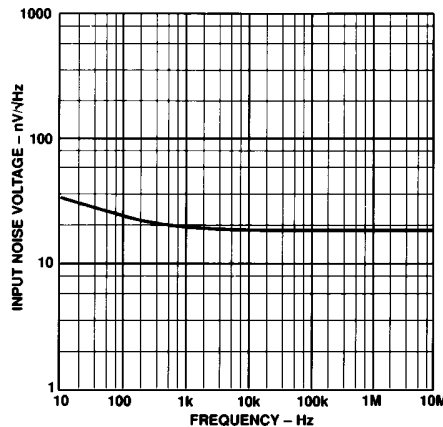


Figure 17. Input Noise Voltage Spectral Density

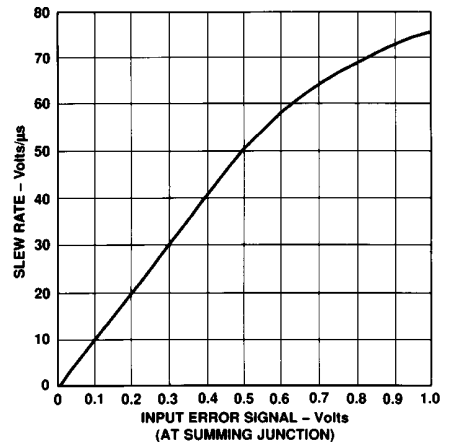


Figure 18. Slew Rate vs. Input Error Signal

AD746

POWER SUPPLY BYPASSING

The power supply connections to the AD746 must maintain a low impedance to ground over a bandwidth of 13 MHz or more. This is especially important when driving a significant resistive or capacitive load, since all current delivered to the load comes from the power supplies. Multiple high quality bypass capacitors are recommended for each power supply line in any critical application. A 0.1 μF ceramic and a 1 μF tantalum capacitor as shown in Figure 20 placed as close as possible to the amplifier

(with short lead lengths to power supply common) will assure adequate high frequency bypassing, in most applications. A minimum bypass capacitance of 0.1 μF should be used for any application.

If only one of the two amplifiers inside the AD746 is to be utilized, the unused amplifier should be connected as shown in Figure 21a. Note that the noninverting input should be grounded and that R_L and C_L are not required.

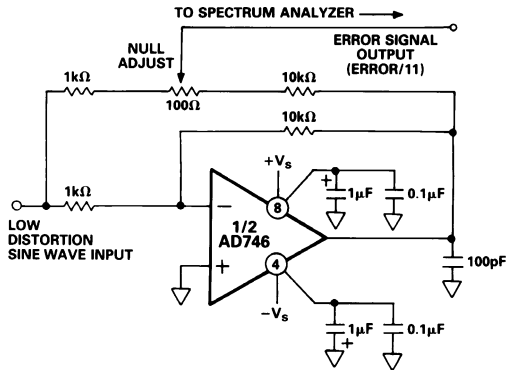


Figure 19. THD Test Circuit

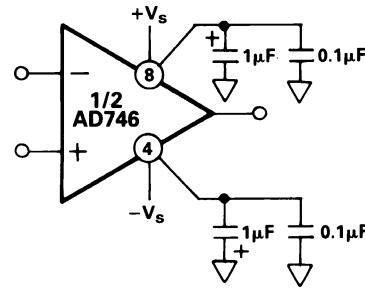


Figure 20. Power Supply Bypassing

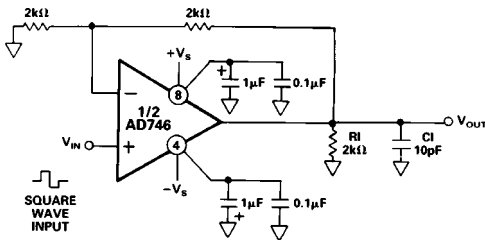


Figure 21a. Gain of 2 Follower

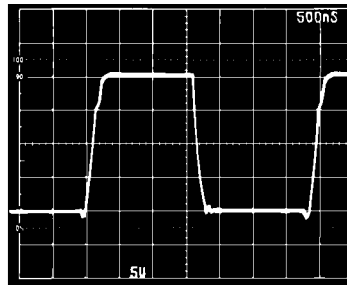


Figure 21b. Gain of 2 Follower Large Signal Pulse Response

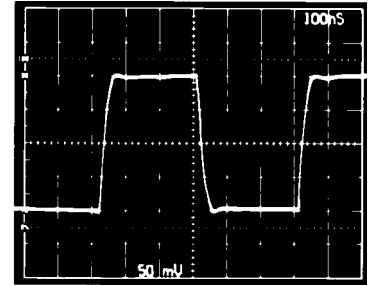


Figure 21c. Gain of 2 Follower Small Signal Pulse Response

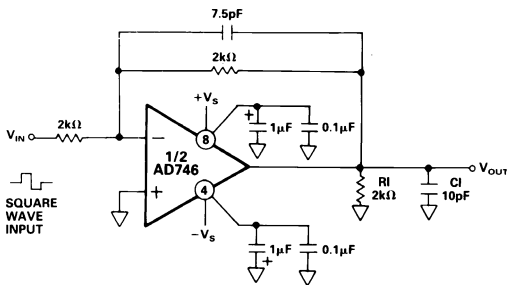


Figure 22a. Unity Gain Inverter

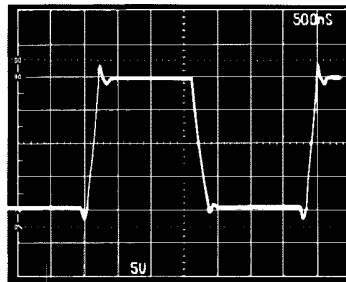


Figure 22b. Unity Gain Inverter Large Signal Pulse Response

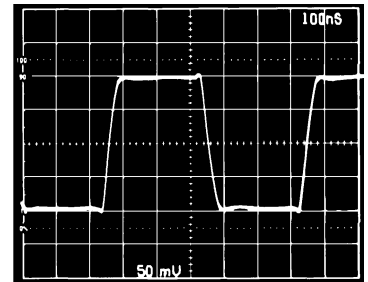


Figure 22c. Unity Gain Inverter Small Signal Pulse Response

AD746

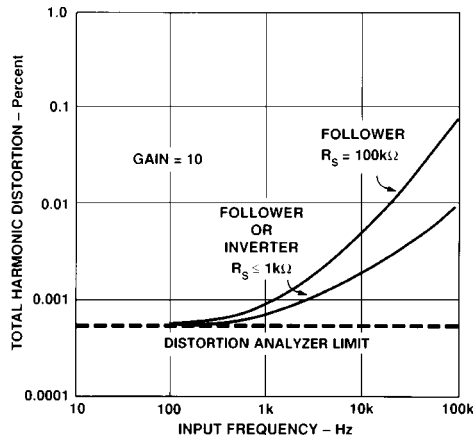


Figure 28. THD vs. Frequency Using Standard Distortion Analyzer

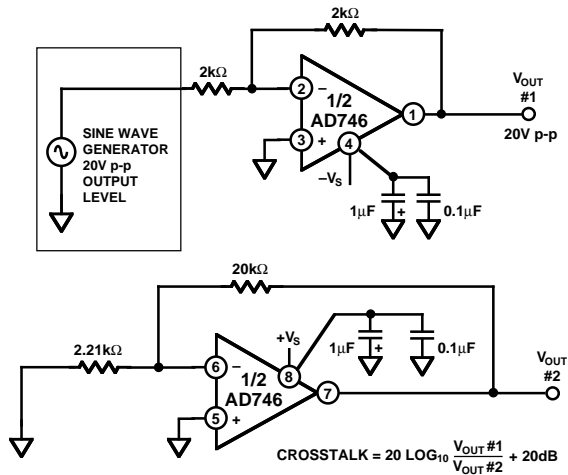


Figure 29. Crosstalk Test Circuit

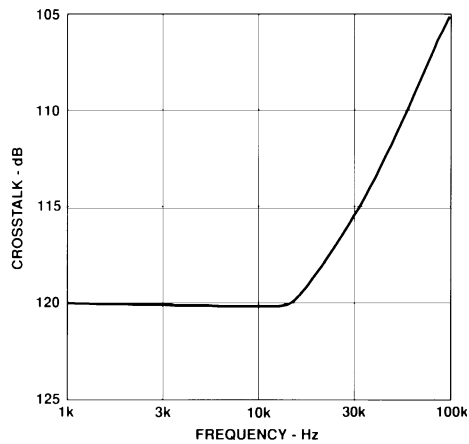
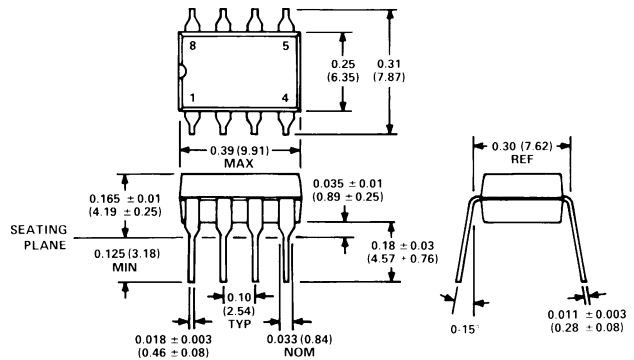


Figure 30. Crosstalk vs. Frequency

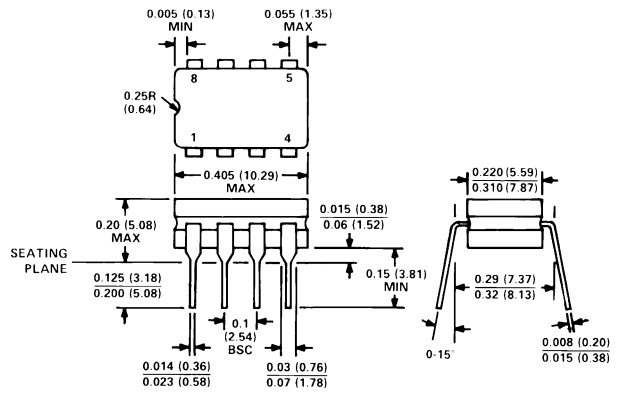
OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).

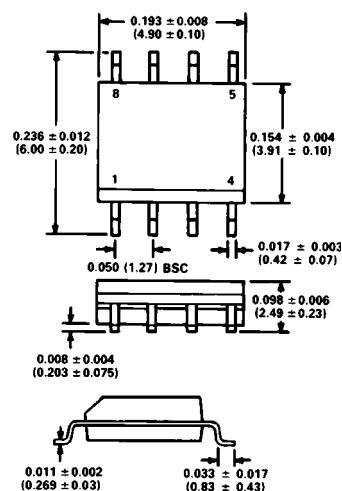
Mini-DIP (N) Package



Cerdip (Q) Package



Plastic Small Outline (R) Package



C1319-10-9/89

PRINTED IN U.S.A.

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

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- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
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- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



Тел: +7 (812) 336 43 04 (многоканальный)

Email: org@lifeelectronics.ru