250 MHz, General Purpose Voltage Feedback Op Amps

AD8047/AD8048

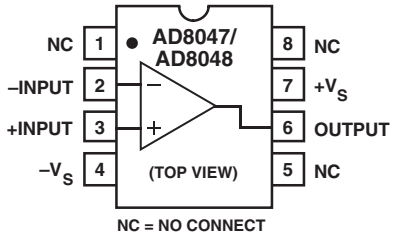
FEATURES

Wide Bandwidth	**AD8047, G = +1**	**AD8048, G = +2**
Small Signal	**250 MHz**	**260 MHz**
Large Signal (2 V p-p)	**130 MHz**	**160 MHz**

5.8 mA Typical Supply Current
Low Distortion, (SFDR) Low Noise
–66 dBc Typ @ 5 MHz
–54 dBc Typ @ 20 MHz
5.2 nV/√Hz (AD8047), 3.8 nV/√Hz (AD8048) Noise
Drives 50 pF Capacitive Load
High Speed
Slew Rate 750 V/μs (AD8047), 1000 V/μs (AD8048)
Settling 30 ns to 0.01%, 2 V Step
±3 V to ±6 V Supply Operation

APPLICATIONS
Low Power ADC Input Driver
Differential Amplifiers
IF/RF Amplifiers
Pulse Amplifiers
Professional Video
DAC Current to Voltage Conversion
Baseband and Video Communications
Pin Diode Receivers
Active Filters/Integrators

FUNCTIONAL BLOCK DIAGRAM
8-Pin Plastic PDIP (N) and SOIC (R) Packages



PRODUCT DESCRIPTION

The AD8047 and AD8048 are very high speed and wide bandwidth amplifiers. The AD8047 is unity gain stable. The AD8048 is stable at gains of two or greater. The AD8047 and AD8048, which utilize a voltage feedback architecture, meet the requirements of many applications that previously depended on current feedback amplifiers.

A proprietary circuit has produced an amplifier that combines many of the best characteristics of both current feedback and voltage feedback amplifiers. For the power (6.6 mA max), the AD8047 and AD8048 exhibit fast and accurate pulse response (30 ns to 0.01%) as well as extremely wide small signal and large signal bandwidth and low distortion. The AD8047 achieves –54 dBc distortion at 20 MHz, 250 MHz small signal, and 130 MHz large signal bandwidths.

The AD8047 and AD8048's low distortion and cap load drive make the AD8047/AD8048 ideal for buffering high speed ADCs. They are suitable for 12-bit/10 MSPS or 8-bit/60 MSPS ADCs. Additionally, the balanced high impedance inputs of the voltage feedback architecture allow maximum flexibility when designing active filters.

The AD8047 and AD8048 are offered in industrial (–40°C to +85°C) temperature ranges and are available in 8-lead PDIP and SOIC packages.

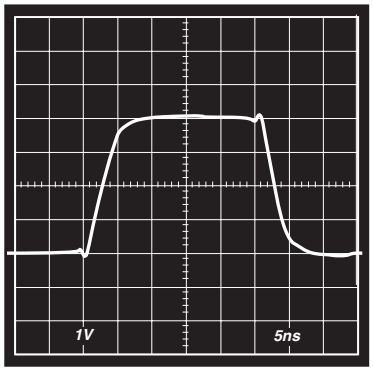


Figure 1. AD8047 Large Signal Transient Response, V_O = 4 V p-p, G = +1

AD8047/AD8048–SPECIFICATIONS

ELECTRICAL CHARACTERISTICS ($\pm V_S = \pm 5$ V, $R_{LOAD} = 100\ \Omega$, $A_V = 1$ (AD8047), $A_V = 2$ (AD8048), unless otherwise noted.)

Parameter	Conditions	AD8047A Min	AD8047A Typ	AD8047A Max	AD8048A Min	AD8048A Typ	AD8048A Max	Unit
DYNAMIC PERFORMANCE								
Bandwidth (–3 dB)								
Small Signal	$V_{OUT} \le 0.4$ V p-p	170	250		180	260		MHz
Large Signal[1]	$V_{OUT} = 2$ V p-p	100	130		135	160		MHz
Bandwidth for 0.1 dB Flatness	$V_{OUT} = 300$ mV p-p							
	AD8047, $R_F = 0\ \Omega$;							
	AD8048, $R_F = 200\ \Omega$		35			50		MHz
Slew Rate, Average +/–	$V_{OUT} = 4$ V Step	475	750		740	1000		V/µs
Rise/Fall Time	$V_{OUT} = 0.5$ V Step		1.1			1.2		ns
	$V_{OUT} = 4$ V Step		4.3			3.2		ns
Settling Time								
To 0.1%	$V_{OUT} = 2$ V Step		13			13		ns
To 0.01%	$V_{OUT} = 2$ V Step		30			30		ns
HARMONIC/NOISE PERFORMANCE								
Second Harmonic Distortion	2 V p-p; 20 MHz		–54			–48		dBc
	$R_L = 1$ kΩ		–64			–60		dBc
Third Harmonic Distortion	2 V p-p; 20 MHz		–60			–56		dBc
	$R_L = 1$ kΩ		–61			–65		dBc
Input Voltage Noise	f = 100 kHz		5.2			3.8		$nV/\sqrt{Hz}$
Input Current Noise	f = 100 kHz		1.0			1.0		$pA/\sqrt{Hz}$
Average Equivalent Integrated								
Input Noise Voltage	0.1 MHz to 10 MHz		16			11		µV rms
Differential Gain Error (3.58 MHz)	$R_L = 150\ \Omega$, G = +2		0.02			0.01		%
Differential Phase Error (3.58 MHz)	$R_L = 150\ \Omega$, G = +2		0.03			0.02		Degree
DC PERFORMANCE[2], $R_L = 150\ \Omega$								
Input Offset Voltage[3]			1	3		1	3	mV
	T_{MIN} to T_{MAX}			4			4	mV
Offset Voltage Drift			±5			±5		µV/°C
Input Bias Current			1	3.5		1	3.5	µA
	T_{MIN} to T_{MAX}			6.5			6.5	µA
Input Offset Current			0.5	2		0.5	2	µA
	T_{MIN} to T_{MAX}			3			3	µA
Common-Mode Rejection Ratio	$V_{CM} = \pm 2.5$ V	74	80		74	80		dB
Open-Loop Gain	$V_{OUT} = \pm 2.5$ V	58	62		65	68		dB
	T_{MIN} to T_{MAX}	54			56			dB
INPUT CHARACTERISTICS								
Input Resistance			500			500		kΩ
Input Capacitance			1.5			1.5		pF
Input Common-Mode Voltage Range			±3.4			±3.4		V
OUTPUT CHARACTERISTICS								
Output Voltage Range, $R_L = 150\ \Omega$		±2.8	±3.0		±2.8	±3.0		V
Output Current			50			50		mA
Output Resistance			0.2			0.2		Ω
Short-Circuit Current			130			130		mA
POWER SUPPLY								
Operating Range		±3.0	±5.0	±6.0	±3.0	±5.0	±6.0	V
Quiescent Current			5.8	6.6		5.9	6.6	mA
	T_{MIN} to T_{MAX}			7.5			7.5	mA
Power Supply Rejection Ratio		72	78		72	78		dB

NOTES

[1]See Absolute Maximum Ratings and Theory of Operation sections.

[2]Measured at $A_V = 50$.

[3]Measured with respect to the inverting input.

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS[1]

Supply Voltage, $(+V_S) - (-V_S)$ . . . . . 12.6 V
Voltage Swing × Bandwidth Product
  AD8047 . . . . . 180 V-MHz
  AD8048 . . . . . 250 V-MHz
Internal Power Dissipation[2]
  Plastic Package (N) . . . . . 1.3 W
  Small Outline Package (R) . . . . . 0.9 W
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 (A Grade) . . . –40°C to +85°C
Lead Temperature Range (Soldering 10 sec) . . . . . 300°C

NOTES

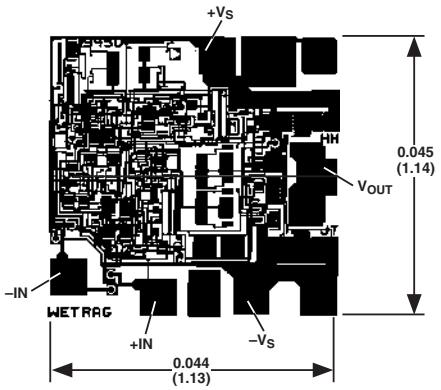
[1] Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

[2] Specification is for device in free air: 8-Lead PDIP Package, θ_{JA} = 90°C/W; 8-Lead SOIC Package, θ_{JA} = 140°C/W

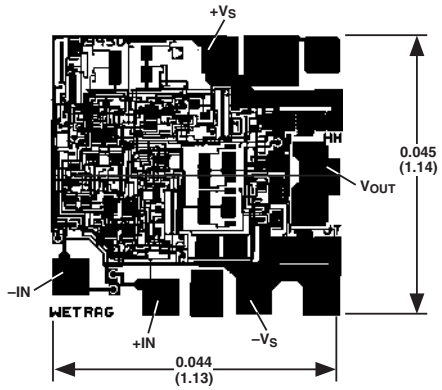
METALLIZATION PHOTOS

Dimensions shown in inches and (mm)
Connect Substrate to $-V_S$.

AD8047



AD8048



MAXIMUM POWER DISSIPATION

The maximum power that can be safely dissipated by these devices is limited by the associated rise in junction temperature. The maximum safe junction temperature for plastic encapsulated devices is determined by the glass transition temperature of the plastic, approximately 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 AD8047 and AD8048 are internally short circuit protected, this may not be sufficient to guarantee that the maximum junction temperature (150°C) is not exceeded under all conditions. To ensure proper operation, it is necessary to observe the maximum power derating curves.

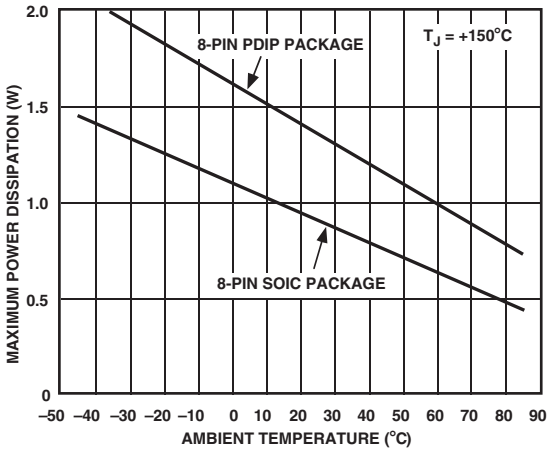


Figure 2. Plot of Maximum Power Dissipation vs. Temperature

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option*
AD8047AN	–40°C to +85°C	PDIP	N-8
AD8047AR	–40°C to +85°C	SOIC	R-8
AD8047AR-REEL	–40°C to +85°C	SOIC	R-8
AD8047AR-REEL7	–40°C to +85°C	SOIC	R-8
AD8048AN	–40°C to +85°C	PDIP	N-8
AD8048AR	–40°C to +85°C	SOIC	R-8
AD8048AR-REEL	–40°C to +85°C	SOIC	R-8
AD8048AR-REEL7	–40°C to +85°C	SOIC	R-8

*N = PDIP, R= SOIC

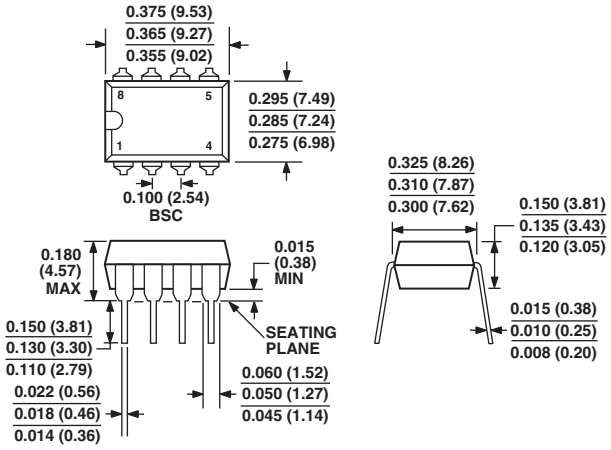
CAUTION

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 AD8047/AD8048 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)

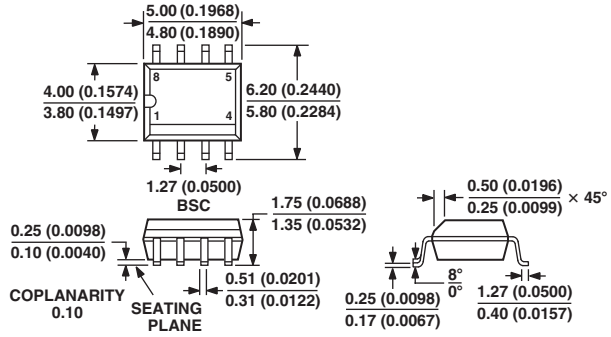
Dimensions shown in inches and (millimeters)



COMPLIANT TO JEDEC STANDARDS MO-095AA
CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETER DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF INCH EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN

8-Lead Standard Small Outline Package [SOIC]
(R-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