Low Power, Unity Gain Fully Differential Amplifier & ADC Driver

Preliminary Technical Data

AD8476

FEATURES

- Very low power
  - 350 µA supply current
- Fully differential or single-ended inputs/outputs
- Differential output designed to drive precision ADCs
  - Drives switched capacitor and Σ-Δ ADCs
  - Rail-to-rail output
- VOCM pin adjusts output common mode
- Robust overvoltage protection up to ±18 V (V_S = +5 V)
- High performance
  - Suitable for driving 16-bit converter up to 250 kSPS
  - 37 nV/√Hz output noise
  - 1 ppm/°C gain drift
  - 500 µV maximum output offset
  - 10 V/µs slew rate
  - 5 MHz bandwidth
- Single supply: 3 V to 18 V
- Dual supplies: ±1.5 V to ±9 V

APPLICATIONS

- ADC driver
- Differential instrumentation amplifier building block
- Single-ended-to-differential converter
- Battery powered instruments

GENERAL DESCRIPTION

The AD8476 is a very low power, fully differential precision amplifier with integrated gain resistors for unity gain. It is an ideal choice for driving low power, high performance ADCs as a single-ended-to-differential or differential-to-differential amplifier. The output common-mode voltage is user adjustable by means of an internal common-mode feedback loop, allowing the AD8476 output to match the input of the ADC. The internal feedback loop also provides exceptional output balance as well as suppression of even-order harmonic distortion products

FUNCTIONAL BLOCK DIAGRAM

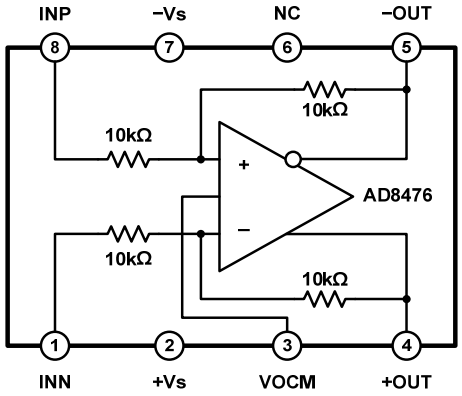

Figure 1. 8-Lead MSOP

Rail-to-rail outputs interface many different signal levels with maximum dynamic range. The AD8476 also provides overvoltage protection from large industrial input voltages up to ±18 V while operating on a single 5 V supply.

The AD8476 works well with SAR, Σ-Δ, and pipeline converters. The high current output stage of the part allows it to drive the switched capacitor front-end circuits of many ADCs with minimal error.

Unlike many differential drivers in the market, the AD8476 is a high precision amplifier. With 200 µV maximum output offset, 37 nV/√Hz noise, and −120 dB THD at 10 kHz, the AD8476 pairs well with low power, high accuracy converters. Considering its low power consumption and high precision, the slew-enhanced AD8476 has excellent speed, settling to 16-bit precision for 250 kSPS acquisition times.

The AD8476 is available in space-saving 8-lead MSOP packages. It is fully specified over the −40°C to +125°C temperature range.

Rev. PrA

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SPECIFICATIONS

V_S = ±5 V, VOCM = 0 V, $V_{OUT} = V_{+OUT} - V_{-OUT}$, R_L = 2 kΩ differential, referred to output (RTO), T_A = 25°C unless otherwise noted.

Table 1.

Parameter	Test Conditions/Comments	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
−3 dB Small Signal Bandwidth	V_{OUT} = 200 mV p-p		5.5		MHz
−3 dB Large Signal Bandwidth	V_{OUT} = 2 V p-p		1		MHz
Slew Rate	V_{OUT} = 2 V step		10		V/µs
Settling Time to 0.01%	V_{OUT} = 2 V step		TBD		ns
Settling Time to 0.001%	V_{OUT} = 2 V step		TBD		ns
NOISE/DISTORTION[1]					
THD + N	f = 10 kHz, V_{OUT} = 2 V p-p, 22 kHz filter		−112		dB
HD2	f = 10 kHz, V_{OUT} = 2 V p-p		TBD		dB
HD3	f = 10 kHz, V_{OUT} = 2 V p-p		TBD		dB
IMD3	f_1 = 95 kHz, f_2 = 105 kHz, V_{OUT} = 2 V p-p		TBD		dBc
Output Voltage Noise	f = 0.1 Hz to 10 Hz		TBD		µV p-p
Spectral Noise Density	f = 10 kHz		37		nV/√Hz
GAIN			1		V/V
Gain Error	$R_L = \infty$			0.03	%
Gain Drift	−40°C ≤ T_A ≤ +125°C			1	ppm/°C
Gain Nonlinearity	V_{OUT} = 4 V p-p				ppm
OFFSET AND CMRR					
Differential Offset[2]			50	500	µV
vs. Temperature	−40°C ≤ T_A ≤ +125°C		1		µV/°C
vs. Power Supply	V_S = ±2.5 V to ±9 V	90			dB
Common-Mode Offset[3]			200		µV
vs. Temperature	−40°C ≤ T_A ≤ +125°C		1		µV/°C
vs. Power Supply	V_S = ±2.5 V to ±9 V	90			dB
Common-Mode Rejection Ratio	V_{INcm} = ±5 V	80			dB
INPUT CHARACTERISTICS					
Input Voltage Range[4]	Differential input	$-V_S$+0.05		$+V_S$−0.05	V
	Single-ended input	2($-V_S$+0.05)		2($+V_S$−0.05)	V
Impedance[5]	$V_{CM} = V_S/2$				
Single-Ended Input					kΩ
Differential Input			20		kΩ
Common Mode Input					kΩ
OUTPUT CHARACTERISTICS					
Output Swing		$-V_S$+0.2		$+V_S$−0.2	
Output Balance Error	$\Delta V_{OUT,cm}/\Delta V_{OUT,dm}$	80			dB
Output Impedance			0.1		Ω
Capacitive Load	Per output		TBD		pF
Short-Circuit Current Limit			TBD		mA
VOCM CHARACTERISTICS					
VOCM Input Voltage Range		$-V_S$+1		$+V_S$−1	V
VOCM Input Impedance			500		kΩ
VOCM Gain Error			TBD		%

Parameter	Test Conditions/Comments	Min	Typ	Max	Unit
POWER SUPPLY					
Specified Supply Voltage			±5		V
Operating Supply Voltage Range		3		18	V
Supply Current	V_S = ±5 V, T_A = 25°C		300	350	µA
Over Temperature	V_S = ±5 V, −40°C ≤ T_A ≤ +125°C		400	500	µA
TEMPERATURE RANGE					
Specified Performance Range		−40		+125	°C

[1] Includes amplifier voltage and current noise, as well as noise of internal resistors.
[2] Includes input bias and offset current errors.
[3] Includes input bias and offset current errors.
[4] The input voltage range is a function of the voltage supplies and ESD diodes.
[5] Internal resistors are trimmed to be ratio matched but have ±20% absolute accuracy.

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
Supply Voltage	±10 V
Maximum Voltage at Any Input Pin	$+V_S$
Minimum Voltage at Any Input Pin	$-V_S$
Storage Temperature Range	−65°C to +150°C
Specified Temperature Range	−40°C to +125°C
Package Glass Transition Temperature (T_G)	150°C

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.

THERMAL RESISTANCE

The θ_{JA} values in Table 3 assume a 4-layer JEDEC standard board with zero airflow.

Table 3. Thermal Resistance

Package Type	θ_{JA}	Unit
8-Lead MSOP	TBD	°C/W

MAXIMUM POWER DISSIPATION

The maximum safe power dissipation for the AD8476 is limited by the associated rise in junction temperature (T_J) on the die. At approximately 150°C, which is the glass transition temperature, the properties of the plastic change. Even temporarily exceeding this temperature limit may change the stresses that the package exerts on the die, permanently shifting the parametric performance of the amplifiers. Exceeding a temperature of 150°C for an extended period may result in a loss of functionality.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

OUTLINE DIMENSIONS

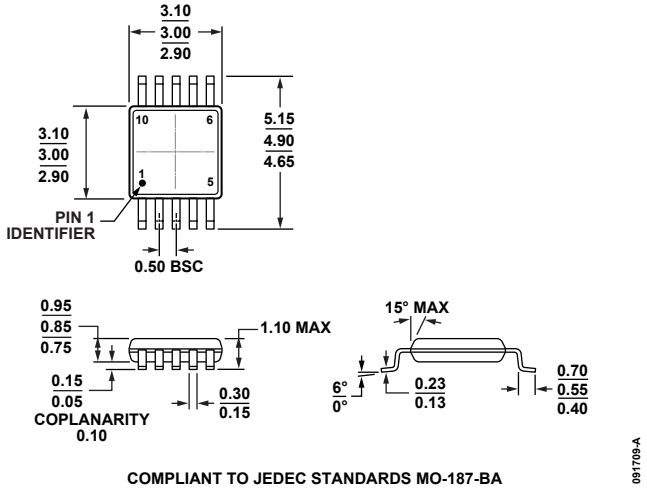

Figure 2. 8-Lead Mini Small Outline Package [MSOP]
(RM-8)
Dimensions shown in millimeters

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