

### FEATURES

- Low offset voltage: 200  $\mu\text{V}$  maximum
- Offset drift: 1  $\mu\text{V}/^\circ\text{C}$  typical
- Very low input bias current: 5 pA maximum
- Extended temperature range:  $-40^\circ\text{C}$  to  $+125^\circ\text{C}$
- $\pm 5\text{ V}$  to  $\pm 15\text{ V}$  dual-supply
- GBW: 80 MHz
- Stable in Gain  $\geq 5$
- Voltage noise: 6.1 nV/ $\sqrt{\text{Hz}}$  at 1 kHz
- High slew rate: 170 V/ $\mu\text{s}$
- High gain: 120 dB typical
- High CMRR: 116 dB typical
- High PSRR: 112 dB typical
- Low supply current: 7.5 mA maximum

### APPLICATIONS

- High impedance sensors
- Photo diode amplifier
- Precision instrumentation
- Phase-locked loop filters
- High end, professional audio
- DAC output amplifier
- ATE
- Medical

### GENERAL DESCRIPTION

The ADA4637-1 is a wide bandwidth de-compensated precision amplifier featuring low noise, very low offset, drift, and bias current. Operation specified from  $\pm 5\text{ V}$  to  $\pm 15\text{ V}$ , dual supply.

The ADA4637-1 provides benefits previously found in few amplifiers. This amplifier combines the best specifications of precision dc and high speed ac op amps.

With a typical offset voltage of only 70  $\mu\text{V}$ , drift of less than 1  $\mu\text{V}/^\circ\text{C}$ , and noise of only 0.86  $\mu\text{V}$  p-p (0.1 Hz to 10 Hz), the ADA4637-1 is suited for applications in which error sources cannot be tolerated.

The ADA4637-1 is specified for both the industrial temperature range of  $-25^\circ\text{C}$  to  $+85^\circ\text{C}$  and the extended industrial temper-

### PIN CONFIGURATIONS

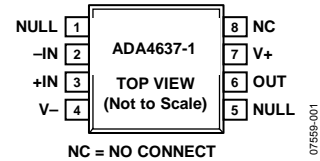
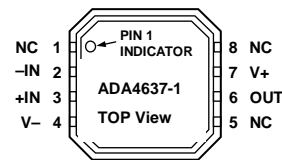


Figure 1. 8-Lead SOIC\_N (R-8)



- NOTES
1. NC = NO CONNECT.
  2. CONNECT EXPOSED PAD TO GROUND.

Figure 2. 8-Lead LFCSP\_VD (CP-8-2)

ature range of  $-40^\circ\text{C}$  to  $+125^\circ\text{C}$ . It is available in tiny 8-lead LFCSP and 8-lead SOIC packages.

The ADA4637-1 is a member of a growing series of high speed, precision op amps offered by Analog Devices, Inc (see Table 1).

Table 1. High Speed Precision Op Amps

Supply	5 V Low Cost	5 V	26 V Low Power	30 V Low Cost	30 V
Single	AD8615	AD8651	AD8610	AD8510	ADA4627-1 ADA4637-1
Dual	AD8616	AD8652	AD8620	AD8512	
Quad	AD8618			AD8513	

#### Rev. PrA

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# SPECIFICATIONS

## ELECTRICAL CHARACTERISTICS—30 V OPERATION

$V_{SY} = \pm 15\text{ V}$ ,  $V_{CM} = 0\text{ V}$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise noted.

Table 2.

Parameter	Symbol	Conditions	B Grade			A Grade			Unit
			Min	Typ	Max	Min	Typ	Max	
INPUT CHARACTERISTICS									
Offset Voltage <sup>1</sup>	$V_{OS}$	$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$ $-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$		70	200		120	300	$\mu\text{V}$
					350			410	$\mu\text{V}$
Offset Voltage Drift, Average	$\Delta V_{OS}/\Delta T$	$-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$		1	2		1	3	$\mu\text{V}/^\circ\text{C}$
Power Supply Rejection Ratio	PSRR	$V_{SY} = \pm 4.5\text{ V to } \pm 18\text{ V}$ $-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$	106	112		103	108		dB
			101			99			dB
Input Bias Current <sup>2</sup>	$I_B$	$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$ $-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$		1	5		1	5	pA
					0.5			0.5	nA
Input Offset Current	$I_{OS}$	$-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$ $-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$		0.5	5		0.5	5	pA
					0.5			0.5	nA
					2			2	nA
NOISE PERFORMANCE									
Voltage Noise Density	$e_n$	$f = 10\text{ Hz}$ $f = 100\text{ Hz}$ $f = 1\text{ kHz}$ $f = 10\text{ kHz}$		16.5	40		16.5	40	$\text{nV}/\sqrt{\text{Hz}}$
				7.9	20		7.9	20	$\text{nV}/\sqrt{\text{Hz}}$
				6.1	8		6.1	8	$\text{nV}/\sqrt{\text{Hz}}$
				4.8	6		4.8	6	$\text{nV}/\sqrt{\text{Hz}}$
Voltage Noise	$e_n\text{ p-p}$	0.1 Hz to 10 Hz		0.69	1.6		0.69	1.6	$\mu\text{V p-p}$
Current Noise Density	$i_n$	$f = 100\text{ Hz}$		1.6			2.5		$\text{fA}/\sqrt{\text{Hz}}$
Current Noise	$I_n\text{ p-p}$	0.1 Hz to 10 Hz		30			48		fA p-p
Input Resistance	$R_{IN}$			10			10		$\text{T}\Omega$
Input Capacitance, Differential Mode	$C_{INDM}$			8			8		pF
Input Capacitance, Common Mode	$C_{INCM}$			7			7		pF
Input Voltage Range		$-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$	-11		+11	-11		+11	V
			-10.5		+10.5	-10.5		+10.5	V
Common-Mode Rejection Ratio	CMRR	$-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$ , $V_{CM} = -11\text{ V to } +11\text{ V}$ $V_{CM} = -10.5\text{ V to } +10.5\text{ V}$	106	116		100	110		dB
Large Signal Voltage Gain	$A_{VO}$	$R_L = 1\text{ k}\Omega$ , $V_O = -10\text{ V to } +10\text{ V}$ $-40 \leq T_A \leq +85^\circ\text{C}$ $-40 \leq T_A \leq +125^\circ\text{C}$	98	120		97	120		dB
			112			106			dB
			110			104			dB
			102			100			dB
DYNAMIC PERFORMANCE									
Slew Rate	SR	10 V step, $R_L = 1\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , $R_S = 499\Omega$ , $R_f = 2\text{ k}\Omega$ , $A_v = -4$		170			170		$\text{V}/\mu\text{s}$
Settling Time to 0.01%	$t_s$	$V_{IN} = 10\text{ V step}$ , $C_L = 35\text{ pF}$ , $R_L = 1\text{ k}\Omega$ , $A_v = -4$		300			300		ns
Settling Time to 0.1%	$t_s$	$V_{IN} = 10\text{ V step}$ , $C_L = 35\text{ pF}$ , $R_L = 1\text{ k}\Omega$ , $A_v = -4$		200			200		ns
Gain Bandwidth Product	GBP	$R_L = 1\text{ k}\Omega$ , $C_L = 20\text{ pF}$ , $A_v = 1$		80		T	80		MHz
Total Harmonic Distortion + Noise	THD + N	$f = 1\text{ kHz}$ , $A_v = 1$		0.000045			0.000045		%

Parameter	Symbol	Conditions	B Grade			A Grade			Unit
			Min	Typ	Max	Min	Typ	Max	
POWER SUPPLY									
Supply Current per Amplifier	$I_{SY}$	$I_O = 0 \text{ mA}$ $-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$		$\pm 7.0$	$\pm 7.5$ $\pm 7.8$		$\pm 7.0$	$\pm 7.5$ $\pm 7.8$	mA mA
OUTPUT CHARACTERISTICS									
Output Voltage High	$V_{OH}$	$R_L = 1 \text{ k}\Omega$ to $V_{CM}$ $-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$ $-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$	12.0 11.8 11.7	12.3		12.0 11.8 11.7	12.3		V V V
Output Voltage Low	$V_{OL}$	$R_L = 1 \text{ k}\Omega$ to $V_{CM}$ $-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$ $-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$		-12.7	-12.3 -12.1 -12.0	-12.7	-12.3 -12.1 -12.0		V V V
Output Current	$I_{out}$	$V_O = \pm 10 \text{ V}$		$\pm 45$			$\pm 45$		mA
Short-Circuit Current	$I_{SC}$	$T_A = 25^\circ\text{C}$		+70/-55			+70/-55		mA
Closed-Loop Output Impedance	$Z_{OUT}$	$f = 1 \text{ MHz}$ , $A_V = -100$		41			41		$\Omega$

<sup>1</sup>  $V_{OS}$  is measured fully warmed-up.

<sup>2</sup> Tested/extrapolated from 125°C

## ABSOLUTE MAXIMUM RATING

Table 3.

Parameter	Rating
Supply Voltage	36 V
Input Voltage Range <sup>1</sup>	(V <sub>-</sub> ) - 0.3 V to (V <sub>+</sub> ) + 0.3 V
Input Current <sup>1</sup>	±10 mA
Differential Input Voltage <sup>2</sup>	±V <sub>SY</sub>
Output Short-Circuit Duration to GND	Indefinite
Storage Temperature Range	-65°C to +150°C
Operating Temperature Range	-40°C to +125°C
Junction Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 60 sec)	300°C
ESD Human Body Model	2.5 kV

<sup>1</sup> Input pin has clamp diodes to the power supply pins. Input current should be limited to 10 mA or less whenever input signals exceed the power supply rail by 0.3 V.

<sup>2</sup> Differential input voltage is limited to ±30 V or the supply voltage, whichever is less.

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

$\theta_{JA}$  is specified for the worst-case conditions, that is, a device soldered in a circuit board for surface-mount packages. This was measured using a standard two-layer board. For the LFCSP package, the exposed pad should be soldered to a copper plane.

Table 4. Thermal Resistance

Package Type	$\theta_{JA}$	$\theta_{JC}$	Unit
8-Lead SOIC_N (R-8)	155	45	°C/W
8-Lead LFCSP (CP-8-2)	77	14	°C/W

## 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.

**ORDERING GUIDE**

Model	Temperature Range	Package Description	Package Option	Branding
ADA4637-1ACPZ-R2 <sup>1</sup>	-40°C to +125°C	8 Lead LFCSP_VD	CP-8-2	A29
ADA4637-1ACPZ-RL <sup>1</sup>	-40°C to +125°C	8 Lead LFCSP_VD	CP-8-2	A29
ADA4637-1ACPZ-R7 <sup>1</sup>	-40°C to +125°C	8 Lead LFCSP_VD	CP-8-2	A29
ADA4637-1ARZ <sup>1</sup>	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADA4637-1ARZ-RL <sup>1</sup>	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADA4637-1ARZ-R7 <sup>1</sup>	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADA4637-1BRZ <sup>1</sup>	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADA4637-1BRZ-R7 <sup>1</sup>	-40°C to +125°C	8-Lead SOIC_N	R-8	
ADA4637-1BRZ-RL <sup>1</sup>	-40°C to +125°C	8-Lead SOIC_N	R-8	

<sup>1</sup> Z = RoHS Compliant Part.