



Single-Supply Differential 18-Bit ADC Driver

Preliminary Technical Data

ADA4941-1

FEATURES

Single-ended-to-differential converter

Ultralow distortion

120 dBc THD @ 10 kHz

Low noise

97 dB SNR @ 100 kHz, $V_o = 4\text{ V p-p}$

Extremely low power

2.1 mA (3 V supply)

High input impedance

Easy-to-use gain adjustment

No external components for $G = +2$

External resistors can be used for additional gain

High speed

32 MHz, -3 dB bandwidth ($G = +2$)

Fast settling time

Rail-to-rail output

Disable

Wide supply voltage range: 2.7 V to 12 V

Available in space-saving packaging: 3 mm × 3 mm LFCSP

APPLICATIONS

Single supply data acquisition systems

Instrumentation

Process control

Battery-power systems

Medical instruments

GENERAL DESCRIPTION

The ADA4941-1 is a low power, differential driver for 16- to 18-bit ADCs. Configured in an easy-to-use, single-ended-to-differential $G = +2$ configuration, the ADA4941-1 requires no external components to drive ADCs with differential inputs provided that the IN- pin is tied to the OUT+ pin. A resistive network around the IN- pin can be used for additional gain as needed. The ADA4941-1 provides essential benefits, such as low distortion and high SNR, that are required for driving high resolution ADCs.

With a wide input voltage range (0 V to 4 V on a single 5 V supply), rail-to-rail output, and high input impedance, the ADA4941-1 is designed to drive single-supply ADCs found in a variety of low power applications, including battery-operated instruments and single-supply data acquisition systems.

FUNCTIONAL BLOCK DIAGRAM

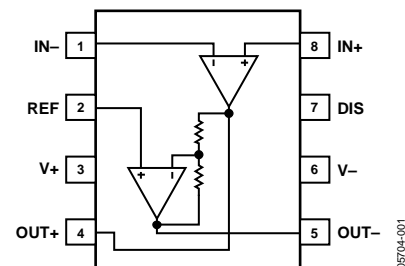


Figure 1.

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The ADA4941-1 is manufactured on ADI's proprietary 2nd generation XFCB process that enables the single-ended-to-differential converter to achieve 18-bit performance using only 2.1 mA of supply current.

The ADA4941-1 is ideal for driving 16- to 18-bit differential PulSAR™ ADCs such as the AD7690 and AD7691.

The ADA4941-1 is available in a small 8 lead LFCSP packaging as well as 8-lead SOIC packaging. The ADA4941-1 is rated to work over the extended industrial temperature range, -40°C to $+125^{\circ}\text{C}$.

Rev. PrA

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REVISION HISTORY

10/05—Revision PrA: Preliminary Version

SPECIFICATIONS

$T_A = 25^\circ\text{C}$, $V_S = 3\text{ V}$, unless otherwise noted.

Table 1.

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
–3 dB Bandwidth	$V_O = 0.1\text{ V p-p}$		30		MHz
	$V_O = 2.0\text{ V p-p}$		6.6		MHz
Overdrive Recovery Time			300		ns
Slew Rate	$V_O = 2\text{ V step}$		22.5		V/ μs
Settling Time 0.0004%	$V_O = 2\text{ V p-p step}$		0.3		μs
NOISE/DISTORTION PERFORMANCE					
THD	$f_c = 10\text{ kHz}$, $V_O = 2\text{ V p-p}$		105		dBc
	$f_c = 1\text{ MHz}$, $V_O = 2\text{ V p-p}$		57		dBc
SNR	$f_c = 100\text{ kHz}$, $V_O = 2\text{ V p-p}$		91		dB
RTO Voltage Noise	$f = 100\text{ kHz}$				nV/ $\sqrt{\text{Hz}}$
Input Current Noise	$f = 100\text{ kHz}$		1		pA/ $\sqrt{\text{Hz}}$
DC PERFORMANCE					
Differential Input Offset Voltage			0.2	.5	mV
Differential Input Offset Voltage Drift					$\mu\text{V}/^\circ\text{C}$
Common-Mode Offset Voltage					mV
Common-Mode Offset Voltage Drift					$\mu\text{V}/^\circ\text{C}$
Input Bias Current	IN and REF		2.2		μA
Input Offset Current	IN and REF		0.2		μA
Gain	$(+OUT - -OUT)/(IN - REF)$		2		V/V
Gain Error			0.1		%
Gain Error Drift			0.01		$\%/^\circ\text{C}$
INPUT CHARACTERISTICS					
Input Resistance	IN and REF		12		M Ω
Input Capacitance	IN and REF		2		pF
Input Common-Mode Voltage Range		0.1		2	V
Common-Mode Rejection Ratio	$V_{CM} = \pm 2.5\text{ V}$		110		dB
OUTPUT CHARACTERISTICS					
Output Voltage Swing: VON	$R_L = 1\text{ k}\Omega$		0.1 to 2.9		V
	$R_L = 1\text{ k}\Omega$		0.1 to 2.9		V
Output Current			25		mA
Capacitive Load Drive					pF
POWER SUPPLY					
Operating Range		2.7		12	V
Quiescent Current			2.1		mA
Quiescent Current—Disable			30		μA
Power Supply Rejection Ration	+PSRR		110		dB
	–PSRR		110		dB
DISABLE					
V_{DIS} High			1.8		V
V_{DIS} Low			1.6		V
Input Current $V_{DIS} = \text{HIGH/LOW}$			5/10		μA
Turn-On Time			30		μs
Turn-Off Time			0.65		μs

$T_A = 25^\circ\text{C}$, $V_S = 5\text{ V}$, unless otherwise noted.

Table 2.

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
–3 dB Bandwidth	$V_O = 0.1\text{ V p-p}$		31		MHz
	$V_O = 2.0\text{ V p-p}$		7.0		MHz
Overdrive Recovery Time	0 V to 5 V step overdrive		350		ns
Slew Rate	$V_O = 2\text{ V step}$		25		V/ μs
Settling Time 0.0004%	$V_O = 6\text{ V p-p step}$		610		ns
NOISE/DISTORTION PERFORMANCE					
THD	$f_c = 10\text{ kHz}$, $V_O = 2\text{ V p-p}$		120		dBc
	$f_c = 1\text{ MHz}$, $V_O = 2\text{ V p-p}$		72		dBc
SNR	$f_c = 100\text{ kHz}$, $V_O = 4\text{ V p-p}$, $f_b = 2\text{ MHz}$		97		dB
RTO Voltage Noise	$f = 100\text{ kHz}$				nV/ $\sqrt{\text{Hz}}$
Input Current Noise	$f = 100\text{ kHz}$				pA/ $\sqrt{\text{Hz}}$
DC PERFORMANCE					
Differential Input Offset Voltage			0.2	.5	mV
Differential Input Offset Voltage Drift					$\mu\text{V}/^\circ\text{C}$
Common-Mode Offset Voltage			0.1	.25	mV
Common-Mode Offset Voltage Drift					$\mu\text{V}/^\circ\text{C}$
Input Bias Current	IN and REF		2.2		μA
Input Offset Current	IN and REF		0.2		μA
Gain	$(\text{OUT}+ - \text{OUT}-)/(\text{IN}+ - \text{REF})$		2		V/V
Gain Error			0.1		%
Gain Error Drift			0.01		$\%/^\circ\text{C}$
INPUT CHARACTERISTICS					
Input Resistance	IN and REF		12		M Ω
Input Capacitance	IN and REF		2		pF
Input Common-Mode Voltage Range		0.1		4	V
Common-Mode Rejection Ratio	$V_{CM} = \pm 2.5\text{ V}$		110		dB
OUTPUT CHARACTERISTICS					
Output Voltage Swing: OUT-	$R_L = 1\text{ k}\Omega$		0.1 to 4.9		V
OUT+	$R_L = 1\text{ k}\Omega$		0.1 to 4.9		V
Output Current			30		mA
Capacitive Load Drive					pF
POWER SUPPLY					
Operating Range		2.7		12	V
Quiescent Current			2.2		mA
Quiescent Current—Disable			40		μA
Power Supply Rejection Ration					
+PSRR			110		dB
–PSRR			110		dB
DISABLE					
V_{DIS} High			3.8		V
V_{DIS} Low			3.6		V
Input Current $V_{DIS} = \text{HIGH/LOW}$			5/12		μA
Turn-On Time			30		μs
Turn-Off Time			0.65		μs

T_A = 25°C, V_S = ±5 V, unless otherwise noted.

Table 3.

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
-3 dB Bandwidth	V _O = 0.1 V p-p		32.5		MHz
	V _O = 2.0 V p-p		7.5		MHz
Overdrive Recovery Time	-5 V to +5 V step overdrive		400		ns
Slew Rate	V _O = 2 V step		26.5		V/μs
Settling Time 0.0005%	V _O = 12 V p-p step		980		ns
NOISE/DISTORTION PERFORMANCE					
THD	f _C = 10 kHz, V _O = 2 V p-p		120		dBc
	f _C = 1 MHz, V _O = 2 V p-p		74		dBc
SNR	f _C = 100 kHz, V _O = 4 V p-p, f _B = 2 MHz		97		dB
RTO Voltage Noise	f = 100 kHz				nV/√Hz
Input Current Noise	f = 100 kHz, IN+ and REF				pA/√Hz
DC PERFORMANCE					
Differential Input Offset Voltage			0.2	0.5	mV
Differential Input Offset Voltage Drift					μV/°C
Common-Mode Offset Voltage			0.1	0.25	mV
Common-Mode Offset Voltage Drift					μV/°C
Input Bias Current	IN+ and REF		2.2		μA
Input Offset Current	IN+ and REF		0.2		μA
Gain	(OUT+ - OUT-)/(IN+ - REF)		2		V/V
Gain Error			0.1		%
Gain Error Drift			0.01		%/°C
INPUT CHARACTERISTICS					
Input Resistance	IN+ and REF		12		MΩ
Input Capacitance	IN+ and REF		2		pF
Input Common-Mode Voltage Range		-4.9		+4	V
Common-Mode Rejection Ratio	V _{CM} = ±2.5 V		110		dB
OUTPUT CHARACTERISTICS					
Output Voltage Swing: OUT-	R _L = 1kΩ		-4.9 to +4.9		V
	R _L = 1kΩ		-4.9 to +4.9		V
Output Current			40		mA
Capacitive Load Drive					pF
POWER SUPPLY					
Operating Range		2.7		12	V
Quiescent Current			2.5		mA
Quiescent Current—Disable			50		μA
Power Supply Rejection Ration	+PSRR		110		dB
	-PSRR		110		dB
DISABLE					
V _{DIS} High			3.8		V
V _{DIS} Low			3.6		V
Input Current V _{DIS} = HIGH/LOW			5/16		μA
Turn-On Time			30		μs
Turn-Off Time			0.65		μs

OUTLINE DIMENSIONS

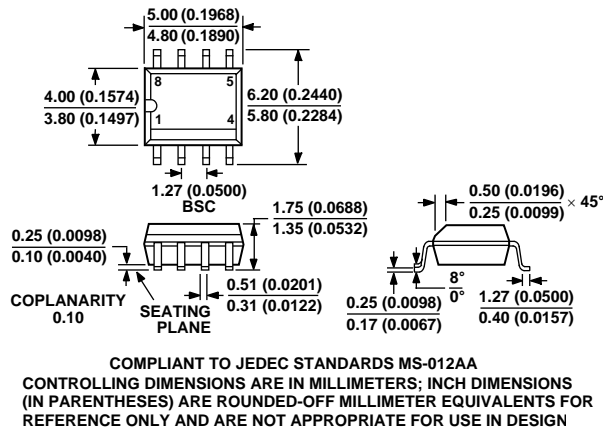


Figure 1. 8-Lead Standard Small Outline Package Narrow Body [SOIC] (R-8)—Dimensions shown in millimeters and (inches)

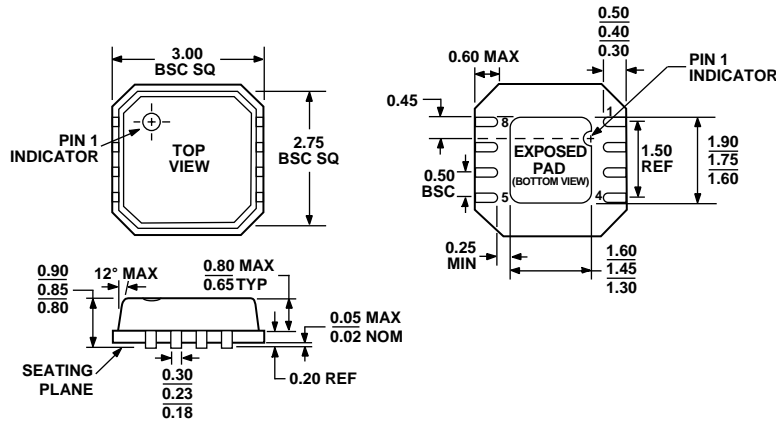


Figure 2. 8-Lead Lead Frame Chip Scale Package [LF CSP], 3 mm x 3 mm Body (CP-8-2)—Dimensions shown in millimeters

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option	Branding
ADA4941-1YRZ ¹	-40°C to +125°C	8-Lead Small Outline Package (SOIC)	R-8	
ADA4941-1YRZ-RL ¹	-40°C to +125°C	8-Lead Small Outline Package (SOIC)	R-8	
ADA4941-1YRZ-R7 ¹	-40°C to +125°C	8-Lead Small Outline Package (SOIC)	R-8	
ADA4941-1YCPZ-R2 ¹	-40°C to +125°C	8-Lead Lead Frame Chip Scale Package (LF CSP)	CP-8-2	H9C
ADA4941-1YCPZ-RL ¹	-40°C to +125°C	8-Lead Lead Frame Chip Scale Package (LF CSP)	CP-8-2	H9C
ADA4941-1YCPZ-R7 ¹	-40°C to +125°C	8-Lead Lead Frame Chip Scale Package (LF CSP)	CP-8-2	H9C

¹ Z = Pb-free part.



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