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 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

FUNCTIONAL BLOCK DIAGRAM

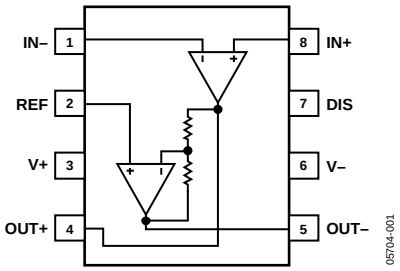

Figure 1.

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.

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°C.

Rev. PrA

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REVISION HISTORY

10/05—Revision PrA: Preliminary Version

SPECIFICATIONS

T_A = 25°C, V_S = 3 V, unless otherwise noted.

Table 1.

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
−3 dB Bandwidth	V_O = 0.1 V p-p		30		MHz
	V_O = 2.0 V p-p		6.6		MHz
Overdrive Recovery Time			300		ns
Slew Rate	V_O = 2 V step		22.5		V/µs
Settling Time 0.0004%	V_O = 2 V p-p step		0.3		µs
NOISE/DISTORTION PERFORMANCE					
THD	f_C = 10 kHz, V_O = 2 V p-p		105		dBc
	f_C = 1 MHz, V_O = 2 V p-p		57		dBc
SNR	f_C = 100 kHz, V_O = 2 V p-p		91		dB
RTO Voltage Noise	f = 100 kHz				nV/√Hz
Input Current Noise	f = 100 kHz		1		pA/√Hz
DC PERFORMANCE					
Differential Input Offset Voltage			0.2	.5	mV
Differential Input Offset Voltage Drift					µV/°C
Common-Mode Offset Voltage					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		0.1		2	V
Common-Mode Rejection Ratio	V_{CM} =±2.5 V		110		dB
OUTPUT CHARACTERISTICS					
Output Voltage Swing: VON	R_L = 1kΩ		0.1 to 2.9		V
VOP	R_L = 1kΩ		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} = HIGH/LOW			5/10		µA
Turn-On Time			30		µs
Turn-Off Time			0.65		µs

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

Table 2.

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
−3 dB Bandwidth	V_O = 0.1 V p-p		31		MHz
	V_O = 2.0 V p-p		7.0		MHz
Overdrive Recovery Time	0 V to 5 V step overdrive		350		ns
Slew Rate	V_O = 2 V step		25		V/µs
Settling Time 0.0004%	V_O = 6 V p-p step		610		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		72		dBc
SNR	f_C = 100 kHz, V_O = 4 V p-p, fb = 2 MHz		97		dB
RTO Voltage Noise	f = 100 kHz				nV/√Hz
Input Current Noise	f = 100 kHz				pA/√Hz
DC PERFORMANCE					
Differential Input Offset Voltage			0.2	.5	mV
Differential Input Offset Voltage Drift					µV/°C
Common-Mode Offset Voltage			0.1	.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		0.1		4	V
Common-Mode Rejection Ratio	V_{CM} = ±2.5 V		110		dB
OUTPUT CHARACTERISTICS					
Output Voltage Swing: OUT-	R_L = 1 kΩ		0.1 to 4.9		V
OUT+	R_L = 1 kΩ		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} = HIGH/LOW			5/12		µA
Turn-On Time			30		µs
Turn-Off Time			0.65		µs

T_A = 25°C, Vs = ±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, fb = 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
OUT+	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

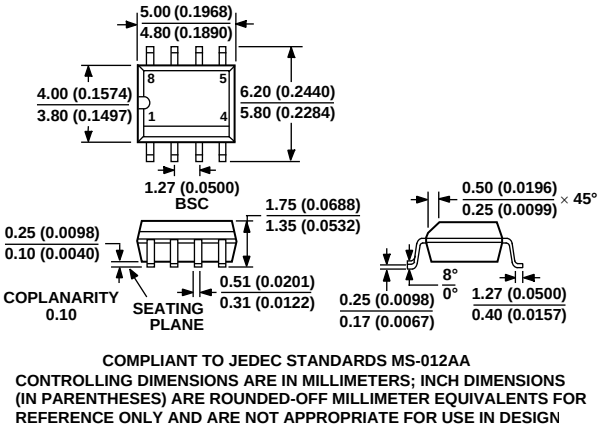

Figure1. 8-Lead Standard Small Outline Package Narrow Body [SOIC] (R-8)—Dimensions shown in millimeters and (inches)

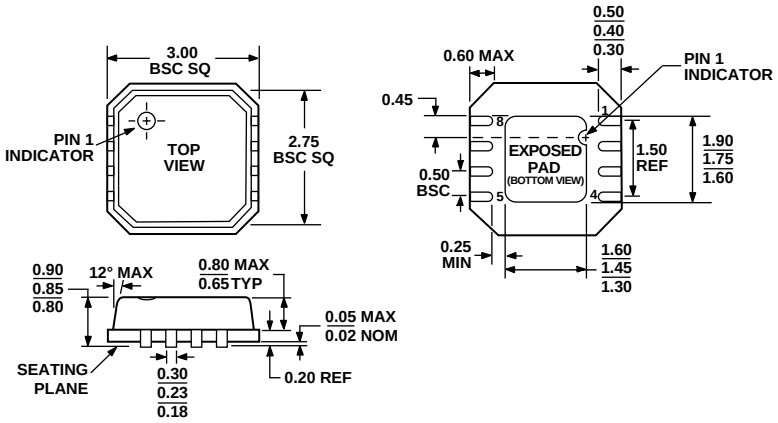

Figure 2. 8-Lead Lead Frame Chip Scale Package [LFCSP], 3 mm × 3 mm Body (CP-8-2)—Dimensions shown in millimeters

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 (LFCSP)	CP-8-2	H9C
ADA4941-1YCPZ-RL[1]	–40°C to +125°C	8-Lead Lead Frame Chip Scale Package (LFCSP)	CP-8-2	H9C
ADA4941-1YCPZ-R7[1]	–40°C to +125°C	8-Lead Lead Frame Chip Scale Package (LFCSP)	CP-8-2	H9C

[1] Z = Pb-free part.

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