

FEATURES

Monolithic 14-Bit, 3 MSPS A/D Converter
Low Power Dissipation: 110 mW
Single +5 V Supply
Integral Nonlinearity Error: 2.5 LSB
Differential Nonlinearity Error: 0.6 LSB
Input Referred Noise: 0.36 LSB
Complete: On-Chip Sample-and-Hold Amplifier and Voltage Reference
Signal-to-Noise and Distortion Ratio: 79.0 dB
Spurious-Free Dynamic Range: 91.0 dB
Out-of-Range Indicator
Straight Binary Output Data
44-Lead MQFP

PRODUCT DESCRIPTION

The AD9243 is a 3 MSPS, single supply, 14-bit analog-to-digital converter (ADC). It combines a low cost, high speed CMOS process and a novel architecture to achieve the resolution and speed of existing hybrid implementations at a fraction of the power consumption and cost. It is a complete, monolithic ADC with an on-chip, high performance, low noise sample-and-hold amplifier and programmable voltage reference. An external reference can also be chosen to suit the dc accuracy and temperature drift requirements of the application. The device uses a multistage differential pipelined architecture with digital output error correction logic to guarantee no missing codes over the full operating temperature range.

The input of the AD9243 is highly flexible, allowing for easy interfacing to imaging, communications, medical, and data-acquisition systems. A truly differential input structure allows for both single-ended and differential input interfaces of varying input spans. The sample-and-hold amplifier (SHA) is equally suited for both multiplexed systems that switch full-scale voltage levels in successive channels as well as sampling single-channel inputs at frequencies up to and beyond the Nyquist rate. Also, the AD9243 performs well in communication systems employing Direct-IF Down Conversion since the SHA in the differential input mode can achieve excellent dynamic performance *well beyond* its specified Nyquist frequency of 1.5 MHz.

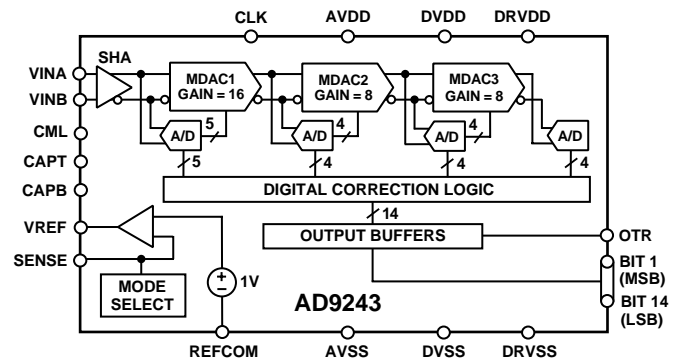
A single clock input is used to control all internal conversion cycles. The digital output data is presented in straight binary output format. An out-of-range (OTR) signal indicates an overflow condition which can be used with the most significant bit to determine low or high overflow.

*Patents pending.

REV. A

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FUNCTIONAL BLOCK DIAGRAM



PRODUCT HIGHLIGHTS

The AD9243 offers a complete single-chip sampling 14-bit, analog-to-digital conversion function in a 44-lead Metric Quad Flatpack.

Low Power and Single Supply

The AD9243 consumes only 110 mW on a single +5 V power supply.

Excellent DC Performance Over Temperature

The AD9243 provides no missing codes, and excellent temperature drift performance over the full operating temperature range.

Excellent AC Performance and Low Noise

The AD9243 provides nearly 13 ENOB performance and has an input referred noise of 0.36 LSB rms.

Flexible Analog Input Range

The versatile onboard sample-and-hold (SHA) can be configured for either single ended or differential inputs of varying input spans.

Flexible Digital Outputs

The digital outputs can be configured to interface with +3 V and +5 V CMOS logic families.

AD9243—SPECIFICATIONS

DC SPECIFICATIONS (AVDD = +5 V, DVDD = +5 V, DRVDD = +5 V, f_{SAMPLE} = 3 MSPS, VREF = 2.5 V, VINB = 2.5 V, T_{MIN} to T_{MAX} unless otherwise noted)

Parameter	AD9243	Units
RESOLUTION	14	Bits min
MAX CONVERSION RATE	3	MHz min
INPUT REFERRED NOISE		
V _{REF} = 1 V	0.9	LSB rms typ
V _{REF} = 2.5 V	0.36	LSB rms typ
ACCURACY		
Integral Nonlinearity (INL)	±2.5	LSB typ
Differential Nonlinearity (DNL)	±0.6	LSB typ
	±1.0	LSB max
INL ¹	±2.5	LSB typ
DNL ¹	±0.7	LSB typ
No Missing Codes	14	Bits Guaranteed
Zero Error (@ +25°C)	0.3	% FSR max
Gain Error (@ +25°C) ²	1.5	% FSR max
Gain Error (@ +25°C) ³	0.75	% FSR max
TEMPERATURE DRIFT		
Zero Error	3.0	ppm/°C typ
Gain Error ²	20.0	ppm/°C typ
Gain Error ³	5.0	ppm/°C typ
POWER SUPPLY REJECTION	0.1	% FSR max
ANALOG INPUT		
Input Span (with V _{REF} = 1.0 V)	2	V p-p min
(with V _{REF} = 2.5 V)	5	V p-p max
Input (VINA or VINB) Range	0	V min
	AVDD	V max
Input Capacitance	16	pF typ
INTERNAL VOLTAGE REFERENCE		
Output Voltage (1 V Mode)	1	Volts typ
Output Voltage Tolerance (1 V Mode)	±14	mV max
Output Voltage (2.5 V Mode)	2.5	Volts typ
Output Voltage Tolerance (2.5 V Mode)	±35	mV max
Load Regulation ⁴	2.0	mV max
REFERENCE INPUT RESISTANCE	5	kΩ typ
POWER SUPPLIES		
Supply Voltages		
AVDD	+5	V (±5% AVDD Operating)
DVDD	+5	V (±5% DVDD Operating)
DRVDD	+5	V (±5% DRVDD Operating)
Supply Current		
IAVDD	23.0	mA max (20 mA typ)
IDRVDD	1.0	mA max (0.5 mA typ)
IDVDD	5.0	mA max (3.5 mA typ)
POWER CONSUMPTION	110	mW typ
	145	mW max

NOTES

¹V_{REF} = 1 V.

²Including internal reference.

³Excluding internal reference.

⁴Load regulation with 1 mA load current (in addition to that required by the AD9243).

Specification subject to change without notice.

AC SPECIFICATIONS (AVDD = +5 V, DVDD = +5 V, DRVDD = +5 V, f_{SAMPLE} = 3 MSPS, VREF = 2.5 V, A_{IN} = -0.5 dBFS, AC Coupled/ Differential Input, T_{MIN} to T_{MAX} unless otherwise noted)

Parameter	AD9243	Units
SIGNAL-TO-NOISE AND DISTORTION RATIO (S/N+D)		
f _{INPUT} = 500 kHz	75.0	dB min
	79.0	dB typ
f _{INPUT} = 1.5 MHz	77.0	dB typ
EFFECTIVE NUMBER OF BITS (ENOB)		
f _{INPUT} = 500 kHz	12.3	Bits min
	12.8	Bits typ
f _{INPUT} = 1.5 MHz	12.5	Bits typ
SIGNAL-TO-NOISE RATIO (SNR)		
f _{INPUT} = 500 kHz	76.0	dB min
	80.0	dB typ
f _{INPUT} = 1.5 MHz	79.0	dB typ
TOTAL HARMONIC DISTORTION (THD)		
f _{INPUT} = 500 kHz	-78.0	dB max
	-87.0	dB typ
f _{INPUT} = 1.5 MHz	-82.0	dB typ
SPURIOUS FREE DYNAMIC RANGE		
f _{INPUT} = 500 kHz	91.0	dB typ
f _{INPUT} = 1.5 MHz	84.0	dB typ
DYNAMIC PERFORMANCE		
Full Power Bandwidth	40	MHz typ
Small Signal Bandwidth	40	MHz typ
Aperture Delay	1	ns typ
Aperture Jitter	4	ps rms typ
Acquisition to Full-Scale Step (0.0025%)	80	ns typ
Overvoltage Recovery Time	167	ns typ

Specifications subject to change without notice.

DIGITAL SPECIFICATIONS (AVDD = +5 V, DVDD = +5 V, T_{MIN} to T_{MAX} unless otherwise noted)

Parameters	Symbol	AD9243	Units
LOGIC INPUTS			
High Level Input Voltage	V _{IH}	+3.5	V min
Low Level Input Voltage	V _{IL}	+1.0	V max
High Level Input Current (V _{IN} = DVDD)	I _{IH}	±10	µA max
Low Level Input Current (V _{IN} = 0 V)	I _{IL}	±10	µA max
Input Capacitance	C _{IN}	5	pF typ
LOGIC OUTPUTS (with DRVDD = 5 V)			
High Level Output Voltage (I _{OH} = 50 µA)	V _{OH}	+4.5	V min
High Level Output Voltage (I _{OH} = 0.5 mA)	V _{OH}	+2.4	V min
Low Level Output Voltage (I _{OL} = 1.6 mA)	V _{OL}	+0.4	V max
Low Level Output Voltage (I _{OL} = 50 µA)	V _{OL}	+0.1	V max
Output Capacitance	C _{OUT}	5	pF typ
LOGIC OUTPUTS (with DRVDD = 3 V)			
High Level Output Voltage (I _{OH} = 50 µA)	V _{OH}	+2.4	V min
Low Level Output Voltage (I _{OL} = 50 µA)	V _{OL}	+0.7	V max

Specifications subject to change without notice.

AD9243

SWITCHING SPECIFICATIONS (T_{MIN} to T_{MAX} with $AVDD = +5\text{ V}$, $DVDD = +5\text{ V}$, $DRVDD = +5\text{ V}$, $C_L = 20\text{ pF}$)

Parameters	Symbol	AD9243	Units
Clock Period ¹	t_C	333	ns min
CLOCK Pulsewidth High	t_{CH}	150	ns min
CLOCK Pulsewidth Low	t_{CL}	150	ns min
Output Delay	t_{OD}	8	ns min
		13	ns typ
		19	ns max
Pipeline Delay (Latency)		3	Clock Cycles

NOTES

¹The clock period may be extended to 1 ms without degradation in specified performance @ +25°C.

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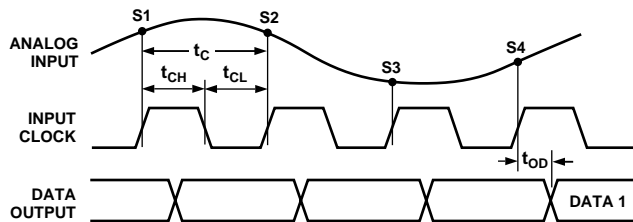


Figure 1. Timing Diagram

THERMAL CHARACTERISTICS

Thermal Resistance

44-Lead MQFP

$\theta_{JA} = 53.2^\circ\text{C/W}$

$\theta_{JC} = 19^\circ\text{C/W}$

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option*
AD9243AS	-40°C to +85°C	44-Lead MQFP	S-44
AD9243EB	Evaluation Board		

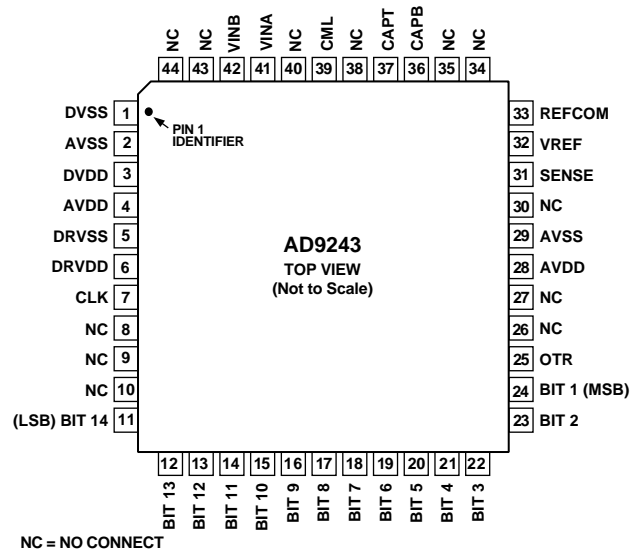
*S = Metric Quad Flatpack.

ABSOLUTE MAXIMUM RATINGS*

Parameter	With Respect to			Units
		Min	Max	
AVDD	AVSS	-0.3	+6.5	V
DVDD	DVSS	-0.3	+6.5	V
AVSS	DVSS	-0.3	+0.3	V
AVDD	DVDD	-6.5	+6.5	V
DRVDD	DRVSS	-0.3	+6.5	V
DRVSS	AVSS	-0.3	+0.3	V
REFCOM	AVSS	-0.3	+0.3	V
CLK	DVSS	-0.3	DVDD + 0.3	V
Digital Outputs	DRVSS	-0.3	DRVDD + 0.3	V
VINA, VINB	AVSS	-0.3	AVDD + 0.3	V
VREF	AVSS	-0.3	AVDD + 0.3	V
SENSE	AVSS	-0.3	AVDD + 0.3	V
CAPB, CAPT	AVSS	-0.3	AVDD + 0.3	V
Junction Temperature			+150	°C
Storage Temperature		-65	+150	°C
Lead Temperature (10 sec)			+300	°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 sections of this specification is not implied. Exposure to absolute maximum ratings for extended periods may effect device reliability.

PIN CONNECTIONS



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 AD9243 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.

