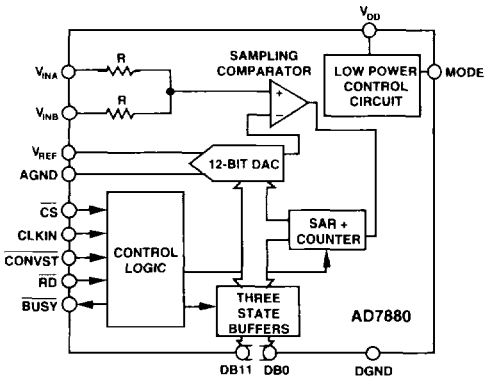
LC²MOS Single +5 V Supply, Low Power, 12-Bit Sampling ADC

AD7880

FEATURES
12-Bit Monolithic A/D Converter
66 kHz Throughput Rate
12 µs Conversion Time
3 µs On-Chip Track/Hold Amplifier
Low Power
Power Save Mode: 2 mW typ
Normal Operation: 25 mW typ
70 dB SNR
Fast Data Access Time: 57 ns
Small 24-Lead SOIC and 0.3" DIP Packages

APPLICATIONS
Battery Powered Portable Systems
Digital Signal Processing
Speech Recognition and Synthesis
High Speed Modems
Control and Instrumentation

FUNCTIONAL BLOCK DIAGRAM



GENERAL DESCRIPTION

The AD7880 is a high speed, low power, 12-bit A/D converter which operates from a single +5 V supply. It consists of a 3 µs track/hold amplifier, a 12 µs successive-approximation ADC, versatile interface logic and a multiple-input-range circuit. The part also includes a power save feature.

An internal resistor network allows the part to accept both unipolar and bipolar input signals while operating from a single +5 V supply. Fast bus access times and standard control inputs ensure easy interfacing to modern microprocessors and digital signal processors.

The AD7880 features a total throughput time of 15 µs and can convert full power signals up to 33 kHz with a sampling frequency of 66 kHz.

In addition to the traditional dc accuracy specifications such as linearity, full-scale and offset errors, the AD7880 is also fully specified for dynamic performance parameters including harmonic distortion and signal-to-noise ratio.

The AD7880 is fabricated in Analog Devices' Linear Compatible CMOS (LC²MOS) process, a mixed technology process that combines precision bipolar circuits with low power CMOS logic. The part is available in a 24-pin, 0.3 inch-wide, plastic or hermetic dual-in-line package (DIP) as well as a small 24-lead SOIC package.

PRODUCT HIGHLIGHTS

1. Fast Conversion Time.
   12 µs conversion time and 3 µs acquisition time allow for large input signal bandwidth. This performance is ideally suited for applications in areas such as telecommunications, audio, sonar and radar signal processing.
2. Low Power Consumption.
   2 mW power consumption in the power-down mode makes the part ideally suited for portable, hand held, battery powered applications.
3. Multiple Input Ranges.
   The part features three user-determined input ranges, 0 V to +5 V, 0 V to 10 V and ±5 V. These unipolar and bipolar ranges are achieved with a 5 V only power supply.

ORDERING GUIDE

Model	Temperature Range	Full-Scale Error (LSBs)	Bipolar Zero Error (LSBs)	Package Option*
AD7880BN	-40°C to +85°C	±15	±10	N-24
AD7880BQ	-40°C to +85°C	±15	±10	Q-24
AD7880CN	-40°C to +85°C	±5	±5	N-24
AD7880CQ	-40°C to +85°C	±5	±5	Q-24
AD7880BR	-40°C to +85°C	±15	±10	R-24
AD7880CR	-40°C to +85°C	±5	±5	R-24

*N = Plastic DIP; Q = Cerdip; R = SOIC (Small Outline Integrated Circuit).
For outline information see Package Information section.

AD7880—SPECIFICATIONS (V_{DD} = +5 V ± 5%, V_{REF} = V_{DD}, AGND = DGND = 0 V, f_{CLKIN} = 2.5 MHz, MODE = V_{DD} unless otherwise noted. All Specifications T_{MIN} to T_{MAX} unless otherwise noted.)

Parameter	B Versions[1]	C Versions[1]	Units	Test Conditions/Comments
DYNAMIC PERFORMANCE[2]				
Signal-to-Noise Ratio[3] (SNR)	70	70	dB min	Typically SNR Is 72 dB V_{IN} = 1 kHz Sine Wave, f_{SAMPLE} = 66 kHz
Total Harmonic Distortion (THD)	-80	-80	dB typ	V_{IN} = 1 kHz Sine Wave, f_{SAMPLE} = 66 kHz
Peak Harmonic or Spurious Noise	-80	-80	dB typ	V_{IN} = 1 kHz, f_{SAMPLE} = 66 kHz
Intermodulation Distortion (IMD)				
Second Order Terms	-80	-80	dB typ	fa = 0.983 kHz, fb = 1.05 kHz, f_{SAMPLE} = 66 kHz
Third Order Terms	-80	-80	dB typ	fa = 0.983 kHz, fb = 1.05 kHz, f_{SAMPLE} = 66 kHz
DC ACCURACY				
Resolution	12	12	Bits	All DC ACCURACY Specifications Apply for the Three Analog Input Ranges
Integral Nonlinearity	±1	±1	LSB max	
Differential Nonlinearity	±1	±1	LSB max	Guaranteed Monotonic
Full-Scale Error	±15	±5	LSB max	
Bipolar Zero Error	±10	±5	LSB max	
Unipolar Offset Error	±5	±5	LSB max	
ANALOG INPUT				
Input Voltage Ranges	0 to V_{REF}	0 to V_{REF}	Volts	See Figure 5
	0 to 2 V_{REF}	0 to 2 V_{REF}	Volts	See Figure 6
	±V_{REF}	±V_{REF}	Volts	See Figure 7
Input Resistance	10	10	MΩ min	0 to V_{REF} Range
	5/12	5/12	kΩ min/max	8 kΩ typical: 0 to 2 V_{REF} Range
	5/12	5/12	kΩ min/max	8 kΩ typical: ±V_{REF} Range
REFERENCE INPUT				
V_{REF} (For Specified Performance)	5	5	V	±5%: Normally V_{REF} = V_{DD} (See Reference Input Section)
I_{REF}	1.5	1.5	mA max	
Nominal Reference Range	2.5/V_{DD}	2.5/V_{DD}	V min/max	See Figure 3 for Degradation in Performance Down to 2.5 V
LOGIC INPUTS				
$\overline{CONVST}$, $\overline{RD}$, $\overline{CS}$, CLKIN				
Input High Voltage, V_{INH}	2.4	2.4	V min	
Input Low Voltage, V_{INL}	0.8	0.8	V max	
Input Current, I_{IN}	±10	±10	μA max	V_{IN} = 0 V or V_{DD}
Input Capacitance, C_{IN}[4]	10	10	pF max	
MODE INPUT				
Input High Voltage, V_{INH}	4	4	V min	
Input Low Voltage, V_{INL}	1	1	V max	
Input Current, I_{IN}	±125	±125	μA max	V_{IN} = 0 V or V_{DD}
Input Capacitance, C_{IN}[4]	10	10	pF max	
LOGIC OUTPUTS				
DB11–DB0, $\overline{BUSY}$				
Output High Voltage, V_{OH}	4.0	4.0	V min	I_{SOURCE} = 400 μA
Output Low Voltage, V_{OL}	0.4	0.4	V max	I_{SINK} = 1.6 mA
DB11–DB0				
Floating-State Leakage Current	±10	±10	μA max	
Floating-State Output Capacitance[4]	10	10	pF max	
CONVERSION				
Conversion Time	12	12	μs max	f_{CLKIN} = 2.5 MHz
Track/Hold Acquisition Time	3	3	μs max	
POWER REQUIREMENTS				
V_{DD}	+5	+5	V nom	±5% for Specified Performance
I_{DD}				
Normal Power Mode @ +25°C	7.5	7.5	mA max	Typically 4 mA; MODE = V_{DD}
T_{MIN} to T_{MAX}	10	10	mA max	Typically 5 mA; MODE = V_{DD}
Power Save Mode @ +25°C	750	750	μA max	Logic Inputs @ 0 V or V_{DD}; MODE = 0 V
T_{MIN} to T_{MAX}	1	1	mA max	Logic Inputs @ 0 V or V_{DD}; MODE = 0 V
Power Dissipation				
Normal Power Mode @ +25°C	37.5	37.5	mW max	V_{DD} = 5 V: Typically 20 mW; MODE = V_{DD}
T_{MIN} to T_{MAX}	50	50	mW max	V_{DD} = 5 V: Typically 25 mW; MODE = V_{DD}
Power Save Mode @ +25°C	3.75	3.75	mW max	V_{DD} = 5 V: Typically 2 mW; MODE = 0 V
T_{MIN} to T_{MAX}	5	5	mW max	V_{DD} = 5 V: Typically 2.5 mW; MODE = 0 V

NOTES
[1]Temperature ranges are as follows: B/C Versions, -40°C to +85°C.
[2]V_{IN} = 0 to V_{REF}
[3]SNR calculation includes distortion and noise components.
[4]Sample tested @ +25°C to ensure compliance.

Specifications subject to change without notice.