

AD9000

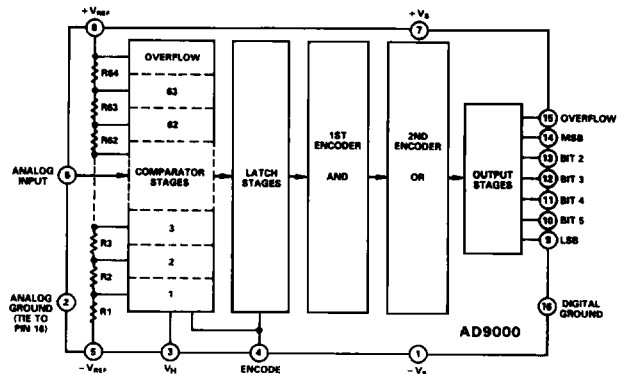
FEATURES

- 77MSPS Encode Rate
- Bipolar Input Range
- Low Error Rate
- Overflow Bit
- MIL-STD-883 Compliant Versions Available

APPLICATIONS

- QAM Telecommunications
- Electronic Warfare (ECM, ECCM, ESM)
- Radar Guidance Digitizers

FUNCTIONAL BLOCK DIAGRAM



GENERAL DESCRIPTION

The AD9000 is a 6-bit, high speed, analog-to-digital converter with ECL compatible outputs and a bipolar input stage. The AD9000 is fabricated in a high-performance bipolar process which allows encode rates up to 77MSPS.

The AD9000 employs the standard flash converter architecture based on 64 individual comparators which simultaneously determine the precise analog signal level. The comparators are followed by two stages of decoding logic, allowing the AD9000 to operate with a very low error rate. The low 35pF input capacitance of the AD9000 greatly simplifies the analog driver stage. Also incorporated into the AD9000 design is an overflow output bit as well as a hysteresis control pin to modify comparator sensitivity.

The AD9000 is offered as both an commercial temperature range device 0 to +70°C, and as an extended temperature range device -55°C to +125°C. Both versions are available packaged in a 16-pin ceramic DIP. The extended temperature range device is also available in a 28-pin ceramic LCC package. The extended temperature range versions are offered as fully compliant MIL-STD-883 Class B devices.

ORDERING GUIDE

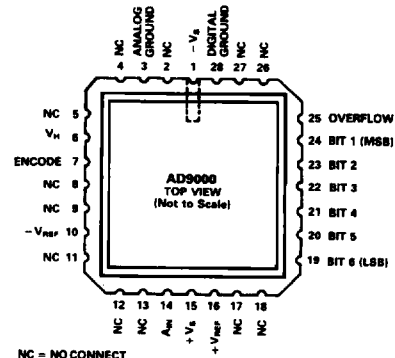
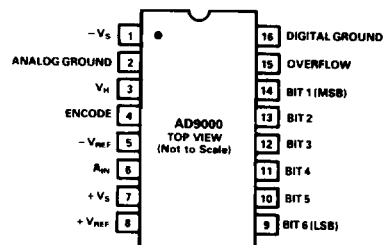
Model ¹	Temperature Range	Description	Package Option ²
AD9000JD	0 to +70°C	16-Pin DIP, Industrial	D-16
AD9000SD	-55°C to +125°C	16-Pin DIP	D-16
AD9000SE	-55°C to +125°C	28-Pin LCC	E-28A

NOTES

¹MIL-STD-883 versions available, contact factory.

²D = Ceramic DIP; E = Leadless Ceramic Chip Carrier. For outline information see Package Information section.

PIN DESIGNATIONS



This is an abridged data sheet. To obtain the most recent version or complete data sheet, call our fax retrieval system at 1-800-446-6212.

AD9000 — SPECIFICATIONS

ELECTRICAL CHARACTERISTICS (Supply Voltages = -5.2V and +5.0V; Differential Reference Voltage = 2.0V unless otherwise stated)

Parameter	Temp	Commercial 0 to +70°C AD9000JD			Military -55°C to +125°C AD9000SD/SE			Units
		Min	Typ	Max	Min	Typ	Max	
RESOLUTION		6			6			Bits
DC ACCURACY								
Differential Linearity	+25°C	0.25	0.5		0.25	0.5		LSB
	Full		1.0			1.0		LSB
Integral Linearity	+25°C	0.25	0.5		0.25	0.5		LSB
	Full		1.0			1.0		LSB
No Missing Codes	Full	GUARANTEED			GUARANTEED			
INITIAL OFFSET ERROR								
Top of Reference Ladder	+25°C	0.3	7/8		0.3	7/8		LSB
	Full		1.5			1.5		LSB
Bottom of Reference Ladder	+25°C	0.25	7/8		0.25	7/8		LSB
	Full		1.5			1.5		LSB
Offset Drift Coefficient	Full	145			145			μV/°C
ANALOG INPUT								
Input Voltage Range	Full	±2.0V			±2.0V			V
Input Bias Current (Sampling) ⁵	Full		800			800		μA
Input Bias Current (Latched) ⁵	Full		20			20		μA
Input Resistance	+25°C	3.0			3.0			kΩ
Input Capacitance	+25°C	35			35			pF
Full Power Bandwidth ⁶	+25°C	20			20			MHz
REFERENCE INPUT ^{2,3}								
Reference Ladder Resistance	+25°C	80	200		80	200		Ω
Ladder Temperature Coefficient		0.275			0.275			Ω/°C
Reference Input Bandwidth	+25°C	20			20			MHz
DYNAMIC PERFORMANCE ⁷								
Conversion Rate	+25°C	50	70		75	77		MHz
Conversion Time (+1 Clock)	+25°C		20			13.3		ns
Aperture Delay (t _D)	+25°C	2			2			ns
Aperture Uncertainty (Jitter)	+25°C	25			25			ps
Output Propagation Delay (t _{PD}) ⁸	+25°C	8	12		8	12		ns
Output Hold Time (t _{OH}) ⁹	+25°C	8	14		8	14		ns
Transient Response ¹⁰	+25°C	13			13			ns
Overvoltage Recovery Time ¹¹	+25°C	11			11			ns
Output Rise Time ¹²	+25°C		5.0			4.5		ns
Output Fall Time ¹²	+25°C		5.0			4.5		ns
Output Time Skew	+25°C	0.4			0.4			ns
ENCODE INPUT								
Logic "1" Voltage	Full	-1.1			-1.1			V
Logic "0" Voltage	Full		-1.5			-1.5		V
Logic "1" Current	Full		100			100		μA
Logic "0" Current	Full		100			100		μA
Input Capacitance	+25°C	2.5			2.5			pF
ENCODE Pulse Width High (t _{PWH})	+25°C	6.6			6.6			ns
ENCODE Pulse Width Low (t _{PWL})	+25°C	6.6			6.6			ns

ELECTRICAL CHARACTERISTICS (Continued)

Parameter	Temp	Commercial 0 to +70°C AD9000JD			Military -55°C to +125°C AD9000SD/SE			Units
		Min	Typ	Max	Min	Typ	Max	
AC LINEARITY¹¹								
Dynamic Linearity ¹²	+25°C		0.5		0.5		LSB	
In-Band Harmonics (DC to 1MHz)	+25°C		44		44		dBc	
(1MHz to 5MHz)	+25°C		42		42		dBc	
(5MHz to 8MHz)	+25°C		38		38		dBc	
Signal to Noise Ratio ¹³	+25°C	31	33	31	33		dB	
Signal to Noise Ratio ¹⁴	+25°C	40	42	40	42		dB	
Two Tone Intermodulation Rejection ¹⁵	+25°C		46		46		dBc	
Noise Power Ratio (NPR) ¹⁶	+25°C		30		30		dBc	
DIGITAL OUTPUTS⁵								
Logic "1" Voltage	Full	-1.1		-1.1			V	
Logic "0" Voltage	Full		-1.5		-1.5		V	
POWER SUPPLY¹⁷								
Positive Supply Current (+5.0V)	+25°C	60	70	60	70		mA	
	Full		75		75		mA	
Negative Supply Current (-5.2V)	+25°C	68	80	68	80		mA	
	Full		85		85		mA	
Nominal Power Dissipation	+25°C	675		675			mW	
Reference Ladder Dissipation	+25°C	20		20			mW	

NOTES

- ¹ $A_{IN} = +V_{REF}$.
²Determined by 3dB reduction in reconstructed output at 75MSPS.
³Under normal operating conditions, the analog input voltages should not exceed nominal $\pm 2V$ operating range, nor the supply voltages ($+V_S$ and $-V_S$), whichever is smaller.
⁴Under normal operating conditions the differential reference voltage may range from $\pm 0.5V$ to $\pm 2V$; $+V_{REF} \geq -V_{REF}$.
⁵Output terminated with 100 Ω resistors to $-2.0V$.
⁶Measured from the leading edge of ENCODE to data out on Bit 1 (MSB).
⁷Measured from the trailing edge of ENCODE to data out on Bit 1 (MSB).
⁸For full-scale step input, 6-bit accuracy is attained in specified time.
⁹Recovers to 6-bit accuracy in specified time, after 150% full-scale input overvoltage.

¹⁰Measured on Bit 1 (MSB) only.

¹¹Measured at 50MSPS encode rate.

¹²Analog input frequency = 15MHz.

¹³RMS signal to RMS noise, with 540kHz analog input signal.

¹⁴Peak-to-peak signal to rms noise, with 540kHz analog input signal.

¹⁵ $f_1 = 9.3MHz$; $f_2 = 7.6MHz$; Encode = 42MHz.

¹⁶DC to 8.2MHz noise bandwidth with 3.886MHz slot.

¹⁷Supply voltage should remain stable within $\pm 5\%$ for normal operation.

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS¹

Positive Supply Voltage	-0.3V to +6V
Negative Supply Voltage	-6.0V to +0.3V
Analog-to-Digital Ground Voltage Differential	0.5
Analog Input Voltages (A_{IN} , $+V_{REF}$, $-V_{REF}$) ²	$\pm 3V$
Differential Reference Voltage ($+V_{REF}$ to $-V_{REF}$) ³	6V
ENCODE Input Voltage	$-V_S$ to 0V
HYSTERESIS Control Voltage	0V to +3.0V
Digital Output Current	20mA
Power Dissipation (+25°C Free Air) ⁴	745mW
Operating Temperature Range	
AD9000JD	0 to +70°C
AD9000SD/SE	-55°C to +125°C
Storage Temperature Range	-65°C to +150°C
Junction Temperature	+175°C
Lead Soldering Temperature (10sec)	+300°C

NOTES

- ¹Absolute maximum ratings are limiting values, to be applied individually, and beyond which serviceability of the circuit may be impaired. Functional operability under any of these conditions is not necessarily implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
²Under normal operating conditions, the analog input voltages should not exceed nominal $\pm 2V$ operating range, nor the supply voltages ($+V_S$ and $-V_S$), whichever is smaller.
³Under normal operating conditions the differential reference voltage may range from $\pm 0.5V$ to $\pm 2V$; $+V_{REF} \geq -V_{REF}$.
⁴Typical thermal impedances
 16-Pin Ceramic $\theta_{JA} = 67^\circ C/W$; $\theta_{JC} = 7^\circ C/W$
 28-Pin LCC $\theta_{JA} = 62^\circ C/W$; $\theta_{JC} = 14^\circ C/W$