

1.1 Scope.

This specification covers the detail requirements for a monolithic CMOS 8-bit, voltage output, digital-to-analog converter with output amplifier and double-buffered interface logic. No external trims are required to achieve full specified performance for the part.

1.2 Part Number.

The complete part numbers per Tables 1 and 2 of this specification are as follows:

Device	Part Number ¹
– 1	AD7224T(X)/883B
– 2	AD7224U(X)/883B

NOTE

¹See paragraph 1.2.3 for package identifier.

1.2.3 Case Outline.

See Appendix 1 of General Specification ADI-M-1000: package outline:

(X)	Package	Description
Q	Q-18	18-Pin Cerdip
E	E-20A	20-Contact LCC

1.3 Absolute Maximum Ratings. (T_A = +25°C unless otherwise noted)

V _{DD} to AGND	– 0.3V, +17V
V _{DD} to DGND	– 0.3V, +17V
V _{SS} to AGND	– 7V, V _{DD}
V _{SS} to DGND	– 7V, V _{DD}
V _{DD} to V _{SS}	– 0.3V, +24V
AGND to DGND	– 0.3V, +V _{DD}
Digital Input Voltage to DGND	– 0.3V, V _{DD}
V _{REF} to AGND	– 0.3V, V _{DD}
V _{OUT} to AGND	– 0.3V, V _{DD}
V _{OUT} to AGND	V _{SS} , V _{DD}
Power Dissipation	
Up to +75°C	450mW
Derates above +75°C	6mW/°C
Operating Temperature Range	–55°C to +125°C
Storage Temperature	–65°C to +150°C
Lead Temperature (Soldering 10sec)	+300°C

1.5 Thermal Characteristics.

Thermal Resistance θ_{JC} = 35°C/W for Q-18 and E-20A

θ_{JA} = 120°C/W for Q-18 and E-20A

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Table 1.

Test	Symbol	Device	Design Limit $T_{min}-T_{max}$	Sub Group 1	Sub Group 2, 3	Sub Group 4	Test Condition ¹	Units
Resolution	RES	-1, 2	8					Bits
Relative Accuracy	RA	-1	1	1	1		$V_{DD} = +14V$; $V_{SS} = -5V$; $V_{REF} = +10V$	$\pm$ LSB max
		-2	1/2	1	1/2	1/2		
Total Unadjusted Error	E_T	-1	2	2	2		$V_{DD} = +14V$; $V_{SS} = -5V$; $V_{REF} = +10V$	$\pm$ LSB max
		-2	1	2	1			
Differential Nonlinearity	DNL	-1, 2	1	1	1		Guaranteed Monotonic to 8-Bits	$\pm$ LSB max
Full-Scale Error	A_E	-1	3/2	3/2	3/2		$V_{DD} = +14V$; $V_{SS} = -5V$; $V_{REF} = +10V$	$\pm$ LSB max
		-2	1	3/2	1	1		
Zero Code Error	A_{ZCE}	-1	30	30	30		$V_{DD} = 16.5V, 11.4V$ and $14V$; $V_{SS} = -5V$; $V_{REF} = V_{DD} - 4$	$\pm$ mV max
		-2	20	30	20	20		
Full-Scale Temp Coefficient	dA_E/dT	-1, 2	20				$V_{DD} = 14V$ to $16.5V$, $V_{REF} = +10V$	$\pm$ ppm/ $^{\circ}C$ max
Voltage Output Settling Time ²	t_{SI}	-1, 2	5				Positive Full-Scale Change	μs max
			7				Negative Full-Scale Change	
Voltage Output Slew Rate	t_{SR}	-1, 2	2.5					V/ μs min
Minimum Load Resistance	$R_{L_{MIN}}$	-1, 2	2				$V_{OUT} = +10V$; $V_{DD} = +14V$	k Ω min
Reference Voltage Range	V_{REF}	-1, 2	2 to ($V_{DD} - 4$)					V min to V max
Reference Input Resistance	R_I	-1, 2	8	8	8		$V_{DD} = 14V$	k Ω min
Reference Input Capacitance	C_I	-1, 2	100				Occurs When DAC Is Loaded with All 1's	pF min
Digital Input High Voltage	V_{IH}	-1, 2	2.4	2.4	2.4		$V_{DD} = 11.4V$; $V_{REF} = V_{DD} - 4$	V min
Digital Input Low Voltage	V_{IL}	-1, 2	0.8	0.8	0.8		$V_{DD} = 11.4V$; $V_{REF} = V_{DD} - 4$	V max
Digital Input Leakage Current	I_{IN}	-1, 2	1	1	1		$V_{IN} = 0V$ or V_{DD} ; $V_{DD} = 11.4V$	$\pm$ μA max
Digital Input Capacitance	C_I	-1, 2	8					pF max
Chip Select/Load DAC Pulse Width	t_{LD}	-1, 2	200					ns min
Write/Reset Pulse Width	t_{WR}	-1, 2	200					ns min
Chip Select/Load DAC to Write Setup Time	t_{CS}	-1, 2	0					ns min
Chip Select/Load DAC to Write Hold Time	t_{CH}	-1, 2	0					ns min
Data Valid to Write Setup Time	t_{DS}	-1, 2	100					ns min
Data Valid to Write Hold Time	t_{DH}	-1, 2	10					ns min
Power Supply Voltage Range	V_{DD}	-1, 2	11.4				For Specified Performance	+ V min
			16.5					+ V max
	V_S	-1, 2	4.5				For Specified Performance	- V min
			5.5					- V max
Power Supply Current	I_{DD}	-1, 2	6	4	6		Output Unloaded: $V_{IN} = V_{IL}$ or V_{IH} $V_{DD} = 16.5V$; $V_{SS} = -5.5V$; $V_{REF} = 12.5V$	mA max
	I_{SS}	-1, 2	5	3	5			

NOTE: DUAL SUPPLY OPERATION

¹ $V_{DD} = +11.4V$ to $16.5V$; $V_{SS} = -5V \pm 10\%$; AGND = DGND = 0V; $V_{REF} = +2V$ to ($V_{DD} - 4V$) unless otherwise stated.

² $V_{REF} = +10V$; settling time to $\pm 1/2$ LSB.

Table 2.

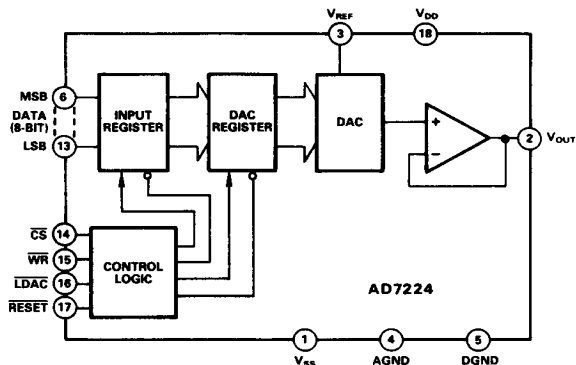
Test	Symbol	Device	Design Limit $T_{min}-T_{max}$	Sub Group 1	Sub Group 2, 3	Sub Group 4	Test Condition ¹	Units
Resolution	RES	- 1, 2	8					Bits
Total Unadjusted Error	E_T	- 1, 2	2	2	2		$V_{DD} = +14V$	$\pm$ LSB max
Differential Nonlinearity	DNL	- 1, 2	1	1	1		$V_{DD} = +14V$; Guaranteed Monotonic to 8-Bits	$\pm$ LSB max
Voltage Output Settling Time ²	t_{SL}	- 1, 2	5				Positive Full-Scale Change	μs max
			20				Negative Full-Scale Change	
Voltage Output Slew Rate	t_{SR}	- 1, 2	2					V/ μs min
Minimum Load Resistance	$R_{L,MIN}$	- 1, 2	2	2	2		$V_{OUT} = +10V$; $V_{DD} = +15V$	k Ω min
Reference Input Resistance	R_I	- 1, 2	8				$V_{DD} = 14.25V$	k Ω min
Reference Input Capacitance	C_I	- 1, 2	100				Occurs When DAC Is Loaded with All 1's	pF max
Digital Input High Voltage	V_{IH}	- 1, 2	2.4	2.4	2.4		$V_{DD} = 14.25V$	V min
Digital Input Low Voltage	V_{IL}	- 1, 2	0.8	0.8	0.8		$V_{DD} = 14.25V$	V max
Digital Input Leakage Current	I_{IN}	- 1, 2	1				$V_{IN} = 0V$ or V_{DD} ; $V_{DD} = 14.25V$	$\pm \mu A$ max
Digital Input Capacitance	C_I	- 1, 2	8					pF max
Chip Select/Load DAC Pulse Width	t_{LD}	- 1, 2	200					ns min
Write/Reset Pulse Width	t_{WR}	- 1, 2	200					ns min
Chip Select/Load DAC to Write Setup Time	t_{CS}	- 1, 2	0					ns min
Chip Select/Load DAC to Write Hold Time	t_{CH}	- 1, 2	0					ns min
Data Valid to Write Setup Time	t_{DS}	- 1, 2	100					ns min
Data Valid to Write Hold Time	t_{DH}	- 1, 2	10					ns min
Power Supply Voltage Range	V_{DD}	- 1, 2	14.25				For Specified Performance	+ V min
			15.75					+ V max
Power Supply Current	I_{DD}	- 1, 2	6				Outputs Unloaded; $V_{IN} = V_{IL}$ or V_{IH} $V_{DD} = 15.75V$	mA max

NOTE: SINGLE SUPPLY OPERATION

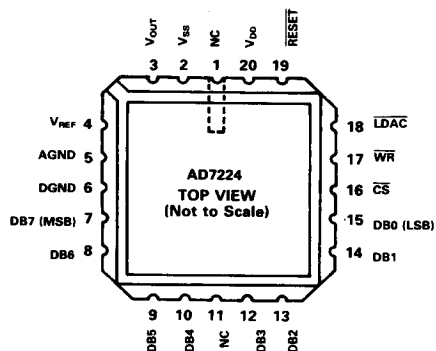
¹ $V_{DD} = +15V \pm 5\%$; $V_{SS} = AGND = DGND = 0V$; $V_{REF} = +10V$ unless otherwise stated.²Settling time to $\pm 1/2$ LSB.

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3.2.1 Functional Block Diagram and Terminal Assignments.



E Package (LCC)

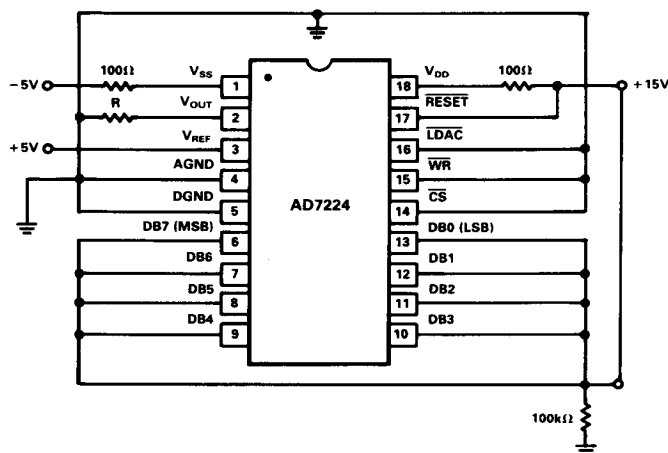


3.2.4 Microcircuit Technology Group.

This microcircuit is covered by technology group (80).

4.2.1 Life Test/Burn-In Circuit.

Steady state life test is per MIL-STD-883 Method 1005. Burn-in is per MIL-STD-883 Method 1015 test condition (B).



NOTE:
VDD IS TURNED ON FIRST, THEN VSS
FOLLOWED BY VREF.

Table 3. AD7224 Truth Table

RESET	LDAC	WR	CS	Function
H	L	L	L	Both Registers are Transparent
H	X	H	X	Both Registers are Latched
H	H	X	H	Both Registers are Latched
H	H	L	L	Input Register Transparent
H	H		L	Input Register Latched
H	L	L	H	DAC Register Transparent
H	L		H	DAC Register Latched
L	X	X	X	Both Registers Loaded With All Zeros
	H	H	H	Both Register Latched With All Zeros and Output Remains at Zero
	L	L	L	Both Registers are Transparent and Output Follows Input Data

H = High State, L = Low State, X = Don't Care

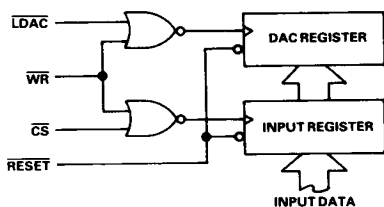


Figure 1. Input Control Logic

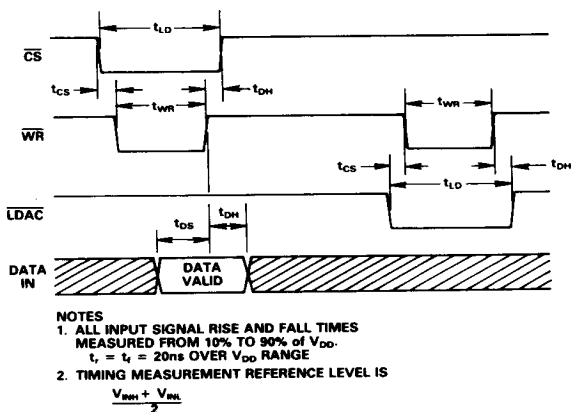


Figure 2. Write Cycle Timing Diagram