ANALOG DEVICES

Wide Temperature Range 12-Bit IC D/A Converter

AD DAC85/AD DAC87

T-51-09-12

1.1 Scope.

This specification covers the device requirements for a high performance 12-bit hybrid digital-to-analog converter. (The monolithic version is detailed on page 619.)

1.2 Part Number.

The complete part number per Table 1 of this specification is as follows:

Device	Part Number
−1	AD DAC85MILCBI-V/883B
−2	AD DAC85MILCBI-I/883B
−3	AD DAC87CBI-V/883B
−4	AD DAC87CBI-I/883B

1.2.3 Case Outline.

See Appendix 1 of General Specification ADI-H-1000: package outline: DH-24A.

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

Positive Supply Voltage V_{CC} to Digital Return . . . . . +18V
Negative Supply Voltage V_{EE} to Digital Return . . . . . −18V
Positive Supply Voltage V_{DD} to Digital Return . . . . . +7V
Digital Input Voltage to Digital Return . . . . . 0V to V_{DD}
Output Short Circuit Duration (to Ground Only) 25ms
Junction Temperature . . . . . +175°C
Storage Temperature Range . . . . . −65°C to +150°C
Lead Temperature (Soldering 10sec) . . . . . +300°C

1.5 Thermal Characteristics.

Thermal Resistance θ_{JC} = 7°C/W
θ_{JA} = 37°C/W

AD DAC85/AD DAC87 – SPECIFICATIONS

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Test	Symbol	Device	Design Limit +25°C (−55°C to +125°C)	Sub Group 1	Sub Group 2,3	Sub Group 4	Test Condition[1,2]	Units
Logic Levels								
Digital Input High	V_{IH}	−1,2,3,4	2.0			2.0		+V min
Digital Input Low	V_{IL}	−1,2,3,4	0.8			0.8		+V max
Digital Input High Current	I_{IH}	−1,2,3,4	1			1	V_{IH} = 5.0V	−μA min
			250			250		+μA max
Digital Input Low Current	I_{IL}	−1,2,3,4	10			10	V_{IL} = +0.8V	−μA min
			100			100		+μA max
Gain Error[3]	A_E	−1,2	0.3	0.3			Input Bits = 0000 0000 0000 To Input Bits = 1111 1111 1111 Unipolar V_{FSR} = 10V	±% FSR max
		−3,4	0.2			0.2		
Gain Error Drift	TCA_E	−1,2	20		20		Input Bits = 0000 0000 0000 Unipolar = 0 to +10V	±ppm/°C max
		−3,4	25		25		Unipolar = 0 to +10V	
Unipolar Offset	V_{OS}	−1,2	0.15	0.15			Input Bits = 1111 1111 1111 Unipolar V_{FSR} = 10V	±% FSR max
		−3,4	0.10			0.10		
Unipolar Offset Drift	TC_{VOS}	−1,2,3,4	3		3		Input Bits = 1111 1111 1111 Unipolar V_{FSR} = 10V	±ppm/°C max
Bipolar Offset	B_{POE}	−1,2	0.15	0.15			Input Bits = 1111 1111 1111	± % FSR max
		−3,4	0.10			0.10		
Bipolar Offset Drift	TCB_{POE}	−1,2,3,4	10		10		Input Bits = 1111 1111 1111	±ppm/°C max
Unipolar Zero Error Current Output	I_{OS}	−2,4	3	3			Input Bits = 1111 1111 1111	μA max
Bipolar Zero Error Current Output	I_{BPZE}	−2,4	3	3			Input Bits = 0111 1111 1111	μA max
Bipolar Gain Error Current Output	I_{BPGE}	−2,4	0.96			0.96	Input Bits = 0000 0000 0000	−μA max
			1.04			1.04		−μA min
Bipolar Offset Error Current Output	I_{BPOE}	−2,4	0.96			0.96	Input Bits = 1111 1111 1111	+μA min
			1.04			1.04		+μA max
Unipolar Gain Error Current Output	I_{OGE}	−2,4	2.3995			2.3995	Input Bits = 0000 0000 0000	−μA min
			1.5995			1.5995		−μA max
Bipolar Zero Error	B_{PZ}	−1,2	0.15	0.15			Input Bits = 0111 1111 1111	±% FSR max
		−3,4	0.10			0.10		
Compliance Voltage	C_V	−2,4	2.5					−V min
			10					+V max
Differential Linearity Error	D_{LE}	−1,2,3,4	1/2	1/2			(Abbreviate Codes Test)	±LSB max
Differential Linearity Error T_A @ T_{min} to T_{max}	TCD_{LE}	−1,2 −3,4	1.0		1.0		(Abbreviate Codes Test) (Monotonic Over Temperature Range)	±LSB max
Linearity Error	LE	−1,2,3,4	0.5	0.5			(Abbreviate Codes Test)	±LSB max
Linearity Error T_A @ T_{min} to T_{max}	TC_{LE}	−1,2,3,4	0.75		0.75		(Abbreviate Codes Test)	±LSB max
Positive Summation Error	E_{PE}	−1,2,3,4	0.50	0.50				±LSB max
Negative Summation	E_{NE}	−1,2,3,4	0.50	0.50				±LSB max
Positive Summation Error Drift	E_{PETC}	−1,2,3,4	0.75		0.75			±LSB max
Negative Summation Error Drift	E_{NETC}	−1,2,3,4	0.75		0.75			±LSB max
Reference Output Error	V_{REF}	−1,3	126			126	V_{REF} = 6.3V	±mV max

Table 1. (Continued on next page)

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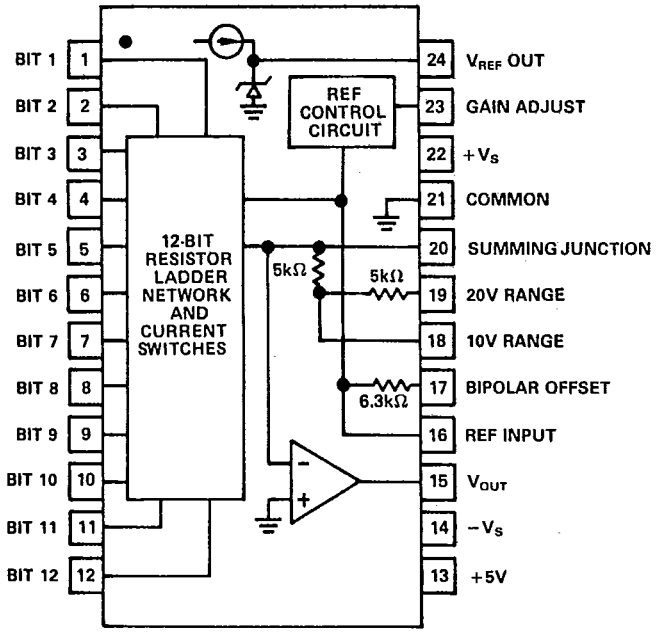
Test	Symbol	Device	Design Limit +25°C (−55°C to +125°C)	Sub Group 1	Sub Group 2,3	Sub Group 4	Test Condition[1,2]	Units
Reference Output Temperature Coefficient	TCV_{REF}	−1 −3	(20) (10)		20 10			± ppm/°C max
Settling Time	t_{SL}	−1,3	7				Settling Time to ±0.01% FSR for FSR Change (2kΩ‖500pF with 10k Feedback Resistor)	µs max
	t_{SL}	−1,3	3				Small Signal Change (1LSB) Settling within 1/2LSB	µs max
	t_{SL}	−2,4	300				Settling Time to ±0.01% of FSR for FSR Change 10 to 100Ω Load	ns typ
	t_{SL}	−2,4	1				For 1kΩ Load	µs typ
+5V Supply Current Drain	$+I_D$	−1,2,3,4	20			20		+ mA max
+15V Supply Current Drain	$+I_{CC}$	−1,2,3,4	20			20		+ mA max
−15V Supply Current Drain	$+I_{EE}$	−1,2,3,4	35			35		− mA max
Power Supply Gain Sensitivity Δ Gain	PSRR	−1,3	0.003			0.003	+5V, +15V, −15V; Supplies ±5% Variation	±%/FS/%V_S
Power Supply Gain Sensitivity Δ Gain T_{min} to T_{max}	TCPSRR	−1,3	(0.03)				+5V, +15V, −15V; Supplies ±5% Variation	±%/FS/%V_S

NOTES
[1] T_A = +25°C and $\pm V_S$ = ±15V unless otherwise specified.
[2] V_{SS} = ±15V, V_D = +5V unless otherwise noted.
[3] Adjustable to zero.

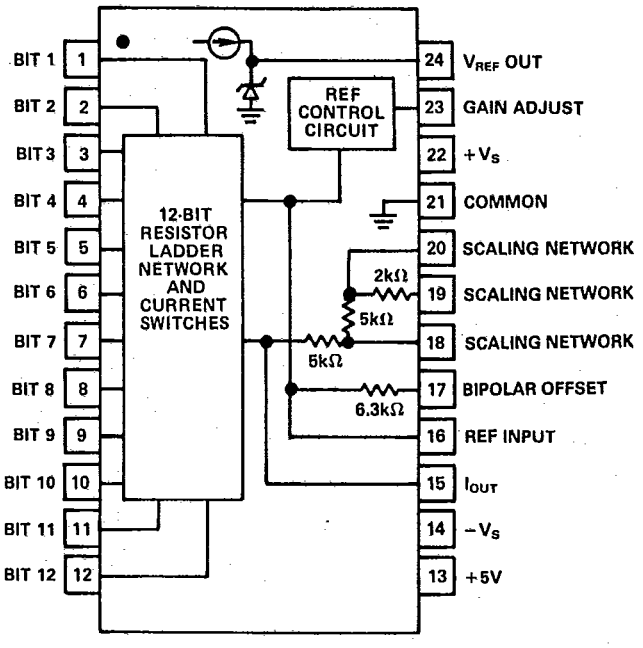
Table 1.

3.2.1 Functional Block Diagram and Terminal Assignments.



Device – 1 or 3

Voltage Model Functional Diagram and Pin Configuration



Device – 2 or 4

Current Model Functional Diagram and Pin Configuration

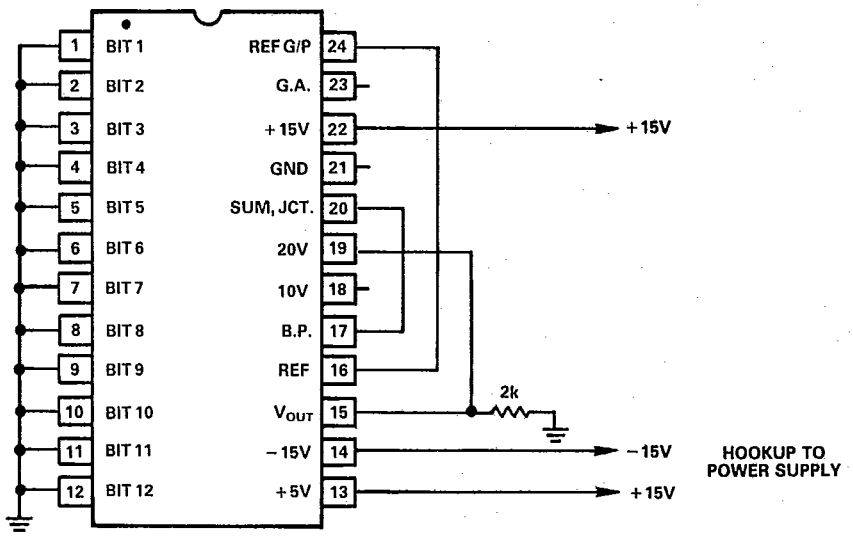
REV. C

3.2.4 Microcircuit Technology Group.

This microcircuit is covered by technology group (I).

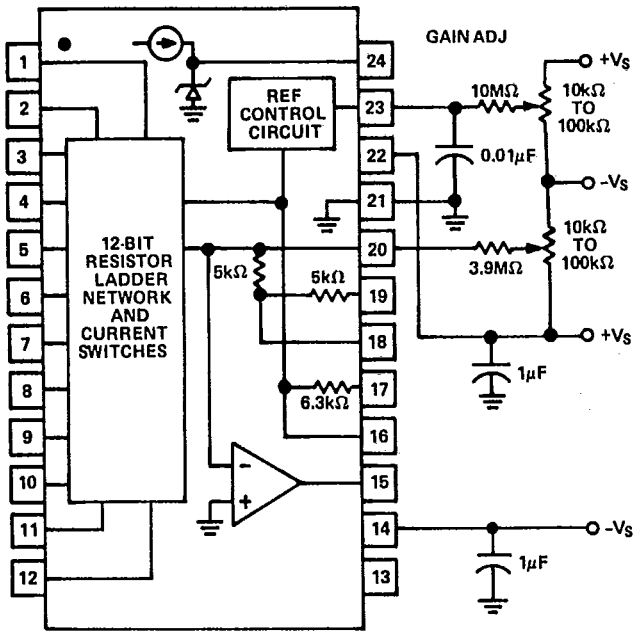
4.2.1 Life Test/Burn-In Circuit.

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

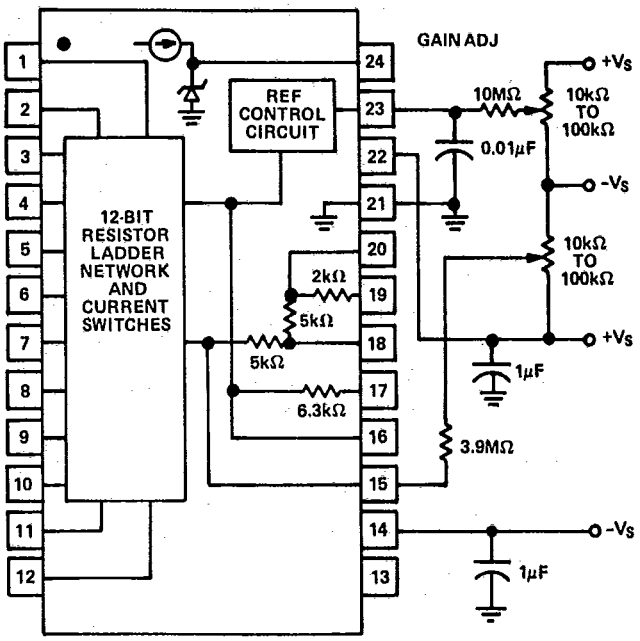


Output Range	Digital Input Codes	Connect Pin 15 to	Connect Pin 17 to	Connect Pin 19 to	Connect Pin 16 to
±10V	COB or CTC	19	20	15	24
±5V	COB or CTC	18	20	N.C.	24
±2.5V	COB or CTC	18	20	20	24
0 to +10V	CSB	18	21	N.C.	24
0 to +5V	CSB	18	21	20	24
0 to +10V	CCD	19	N.C.	15	24

Table 2. Digital Input/Analog Output



Device – 1 or 3
External Adjustment and Voltage Supply Connection Diagram



Device – 2 or 4
External Adjustment and Voltage Supply Connection Diagram

Digital Input		Analog Output			
12 Bit Resolution		Voltage*		Current	
MSB	LSB	0 to +10V	±10V	0 to −2mA	±1mA
CBI Model 0 0 0 0 0 0 0 0 0 0 0 0		+9.9976V	+9.9951V	−1.9995mA	−0.9995mA
0 1 1 1 1 1 1 1 1 1 1 1		+5.0000V	00000V	−1.0000mA	0.0000mA
1 0 0 0 0 0 0 0 0 0 0 0		+4.9976V	−0.0049V	0.488mA	+1.000mA
1 1 1 1 1 1 1 1 1 1 1 1		0.0000V	−10.0000V	0.0000mA	0.488μA
1LSB		2.44mV	4.88mV	−0.9995mA	+0.0005mA

*To obtain values for other binary ranges 0 to +5V range: divide 0 to +10 values by 2; ±5V range: divide ±10V range values by 2; ±2.5V range: divide ±10V range values by 4.

Table 3. Output Voltage Range Connections-Voltage