



ADC-910/883

10-BIT HIGH-SPEED "MICROPROCESSOR COMPATIBLE" A/D CONVERTER

Precision Monolithics Inc.

1.0 SCOPE

This specification covers the detail requirements for a 10-bit microprocessor compatible monolithic analog-to-digital converter which uses the successive-approximation technique to provide a conversion time of 6 μ s.

It is highly recommended that this data sheet be used as a baseline for new military or aerospace spec control drawings.

1.2 Part Number. The complete part numbers per Table 1 of this specification follow:

<u>Device</u>	<u>Part Number</u>	<u>Package</u>
A	ADC-910AT/883	T
B	ADC-910BT/883	T

1.2.3 Case Outline.

<u>Letter</u>	<u>Case Outline (Lead finish per MIL-M-38510)</u>
T	28-Lead Ceramic Dual-in-Line Package

1.3 Absolute Maximum Ratings. ($T_A = +25^\circ\text{C}$, unless otherwise noted)

Supply Voltage (V+)	6V
Supply Voltage (V-)	6V
V+ to V-	12V
Logic Inputs	+6V, -0.3V
Logic Outputs (in 3-state)	+6V, -0.3V
V_{INA}	15V
V_{INB}	7.5V
Reference Inputs	3.0V
Digital Ground to Analog Ground Voltage	0.5V
Power Dissipation	1000mW
Derate Above +50°C	10mW/°C
Operating Temperature Range	-55°C to +125°C
Maximum Junction Temperature (T_J)	150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature Range (Soldering, 60 sec)	+300°C

1.5 Thermal Characteristics:

Thermal Resistance, CERDIP (T) package:

Junction-to-Case (Θ_{JC}) = 18°C/W MAX

Junction-to-Ambient (Θ_{JA}) = 100°C/W MAX

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Table 1

$V_S = \pm 5V, V_{REF} = +2.5V, T_A = +25^\circ C$, unless otherwise specified.

Characteristics	Symbol	Special Conditions	ADC-910/883				Units
			LIMITS A		LIMITS B		
			Min	Max	Min	Max	
Power Supply Current	I+		10	40	10	40	mA
	I-	$-55^\circ C \leq T_A \leq +125^\circ C$	-60	-10	-60	-10	
Reference Voltage Trim Range	REF ADJ Range	$V_{REF ADJ} = 0V \text{ to } V_{REF}$	± 40	--	± 40	--	mV
Analog Input Impedance (10V)	R_{INA}	Pin 20 $-55^\circ C \leq T_A \leq +125^\circ C$	3500	8000	3500	8000	Ω
Analog Input Impedance (5V)	R_{INB}	Pin 19 $-55^\circ C \leq T_A \leq +125^\circ C$	1750	4000	1750	4000	Ω
Reference Input Impedance	R_{REF}	Pin 22 $-55^\circ C \leq T_A \leq +125^\circ C$	1750	3500	1750	3500	Ω
Reference Voltage Output	$V_{REF OUT}$	1mA Load $-55^\circ C \leq T_A \leq +125^\circ C$	2.45 2.43	2.55 2.57	2.45 2.43	2.55 2.57	V
Reference Output Load Regulation	V_{REF} LD REG	1 to 5mA Load $-55^\circ C \leq T_A \leq +125^\circ C$	--	1.5	--	1.5	mV/mA
Reference Line Regulation	V_{REF} LN REG	$V_+ = 4.75V \text{ to } 5.25V$ $V_- = -5V$ $-55^\circ C \leq T_A \leq +125^\circ C$	-600	+600	-600	+600	$\mu V/V$



Table 1 (con't)

$V_S = \pm 5V, V_{REF} = +2.5V, T_A = +25^\circ C$, unless otherwise specified.

Characteristics	Symbol	Special Conditions	ADC-910/883				Units
			LIMITS A		LIMITS B		
			Min	Max	Min	Max	
Gain Error	G_{FSE}	(Notes 1,2,3,4) $-55^\circ C \leq T_A \leq +125^\circ C$	-4 -6.5	+4 +6.5	-6 -8.5	+6 +8.5	LSB
Unipolar Mode Offset Error	V_{ZSE}	10V and 5V Ranges $-55^\circ C \leq T_A \leq +125^\circ C$ (Notes 1,3)	-0.5 -1.0	+0.5 +1.0	-1.0 -1.5	+1.0 +1.5	LSB
Bipolar Mode Offset Error	V_{OSE}	10V and 5V Ranges $-55^\circ C \leq T_A \leq +125^\circ C$ (Notes 2, 4)	-1.0 -1.8	+1.0 +1.8	-1.5 -2.3	+1.5 +2.3	LSB
Integral Nonlinearity	INL	(Note 2) $-55^\circ C \leq T_A \leq +125^\circ C$	-0.5 -0.85	+0.5 +0.85	-1.0 -1.2	+1.0 +1.2	LSB
Differential Nonlinearity	DNL	(Notes 2, 3) $-55^\circ C \leq T_A \leq +125^\circ C$	-1.0	+1.0	-1.0	+1.0	LSB
Positive Power Supply Sensitivity	$+P_{SS}$	$V+ = 4.75V$ to $5.25V$ $V- = -5V$ $-55^\circ C \leq T_A \leq +125^\circ C$ (Notes 3, 4)	-0.5 -1.2	+0.5 +1.2	-0.5 -1.2	+0.5 +1.2	LSB



Table 1 (con't)

$V_S = \pm 5V$, $V_{REF} = +2.5V$, $T_A = +25^\circ C$, unless otherwise specified.

Characteristics	Symbol	Special Conditions	ADC-910/883				Units
			LIMITS A		LIMITS B		
			Min	Max	Min	Max	
Negative Power Supply Sensitivity	$-P_{SS}$	$V+ = 5V$, $V- = -5.25V$ to $-4.75V$ $-55^\circ C \leq T_A \leq +125^\circ C$ (Notes 3, 4)	-0.5	+0.5	-0.5	+0.5	LSB
Gain Drift	TCG_{FS}	External Reference $-55^\circ C$ to $+125^\circ C$ (Notes 1, 2, 3, 4)	--	40	--	50	ppmFS/ $^\circ C$
		Internal Reference $-55^\circ C$ to $+125^\circ C$ (Notes 1, 2, 3, 4)	--	50	--	60	ppmFS/ $^\circ C$
Bipolar Mode Zero Scale Offset Drift	TCV_{ZS}	$-55^\circ C \leq T_A \leq +125^\circ C$ (Notes 2, 4)	--	2.0	--	3.0	LSB
Resolution	N	$-55^\circ C \leq T_A \leq +125^\circ C$	10	--	10	--	Bits
Conversion Time	T_C	(Note 3) (See Figure 1)	--	6	--	6	μs
		(Notes 1,2,4) (See Figure 1)	--	12	--	12	μs
Digital Input High	V_{INH}	$-55^\circ C \leq T_A \leq +125^\circ C$	2.0	--	2.0	--	V



Table 1 (con't)

$V_S = \pm 5V, V_{REF} = +2.5V, T_A = +25^\circ C$, unless otherwise specified.

Characteristics	Symbol	Special Conditions	ADC910/883				Units
			LIMITS A		LIMITS B		
			Min	Max	Min	Max	
Digital Input Low	V_{INL}	$-55^\circ C \leq T_A \leq +125^\circ C$	--	0.8	--	0.8	V
Digital Output Voltage High	V_{OH}	$I_{OH} = -400\mu A$ $-55^\circ C \leq T_A \leq +125^\circ C$	2.4	--	2.4	--	V
Digital Output Voltage Low	V_{OL}	$I_{OL} = 1.6mA$ $-55^\circ C \leq T_A \leq +125^\circ C$	--	0.4	--	0.4	V
Digital Input Current High	I_{INH}	$-55^\circ C \leq T_A \leq +125^\circ C$	-2	+2	-2	+2	μA
Digital Input Current Low	I_{INL}	$-55^\circ C \leq T_A \leq +125^\circ C$	-20	+20	-20	+20	μA
Three State Output Leakage	I_{OZ}	$-55^\circ C \leq T_A \leq +125^\circ C$	-20	+20	-20	+20	μA

NOTES:

1. Tested in 10V unipolar mode @ $F_{CLK} = 0.5MHz$.
2. Tested in 10V bipolar mode @ $F_{CLK} = 0.5MHz$.
3. Tested in 5V unipolar mode @ $F_{CLK} = 1.0MHz$.
4. Tested in 5V bipolar mode @ $F_{CLK} = 0.5MHz$.



TABLE 2

**Electrical Test Requirements
For Class B Devices**

MIL-STD-883 Test Requirement	Subgroups (see Table 3)
Interim Electrical Parameters (pre Burn-In)	1
Final Electrical Test Parameters	1*, 2, 3
Group A Test Requirements	1*, 2, 3, 8

- * PDA applies to Subgroup 1 only.
No other Subgroups are included in PDA.



Table 3

$V_S = \pm 5V, V_{REF} = +2.5V$, unless otherwise specified.

Characteristics	Symbol	Special Conditions	ADC-910/883				Units
			LIMITS A		LIMITS B		
			Min	Max	Min	Max	
Subgroup 1.	I+		10	40	10	40	mA
$T_A = +25^\circ C$	I-		-60	-10	-60	-10	mA
REF ADJ Range	$V_{REF ADJ} = 0V$ to V_{REF}		± 40	--	± 40	--	mV
$R_{IN A}$	Pin 20		3500	8000	3500	8000	Ω
$R_{IN B}$	Pin 19		1750	4000	1750	4000	Ω
R_{REF}	Pin 22		1750	3500	1750	3500	Ω
$V_{REF OUT}$	1mA Load		2.45	2.55	2.45	2.55	V
$V_{REF LD REG}$	1 to 5mA Load		--	1.5	--	1.5	mV/mA
$V_{REF LN REG}$	$V+ = 4.75V$ to $5.25V$ $V- = -5V$		-600	+600	-600	+600	$\mu V/V$
G_{FSE}	(Notes 1,2,3,4)		-4	+4	-6	+6	LSB



Table 3 (cont'd)

$V_S = \pm 5V, V_{REF} = +2.5V$, unless otherwise specified.

Characteristics	Symbol	Special Conditions	ADC-910/883				Units
			LIMITS A		LIMITS B		
			Min	Max	Min	Max	
Subgroup 1. (Cont'd) $T_A = +25^\circ C$	V_{ZSE}	10V and 5V Ranges (Notes 1, 3)	-0.5	+0.5	-1.0	+1.0	LSB
	V_{OSE}	10V and 5V Ranges (Notes 2, 4)	-1.0	+1.0	-1.5	+1.5	LSB
	INL	(Note 2)	-0.5	+0.5	-1.0	+1.0	LSB
	DNL	(Notes 2, 3)	-1.0	+1.0	-1.0	+1.0	LSB
	+P _{SS}	V+ = 4.75V to 5.25V V- = -5V (Notes 3, 4)	-0.5	+0.5	-0.5	+0.5	LSB
	-P _{SS}	V+ = 5V V- = -5.25V to -4.75V (Notes 3, 4)	-0.5	+0.5	-0.5	+0.5	LSB
	N		10	--	10	--	Bits
	V_{INH}		2.0	--	2.0	--	V
	V_{INL}		--	0.8	--	0.8	V
V_{OH}	$I_{OH} = -400\mu A$	2.4	--	2.4	--	V	



Table 3 (con't)

$V_S = \pm 5V$, $V_{REF} = +2.5V$, unless otherwise specified.

Characteristics	Symbol	Special Conditions	ADC-910/883				Units
			LIMITS A		LIMITS B		
			Min	Max	Min	Max	
Subgroup 1. (Cont'd) $T_A = +25^\circ C$	V_{OL}	$I_{OL} = 1.6mA$	--	0.4	--	0.4	V
	I_{INH}		-2	+2	-2	+2	μA
	I_{INL}		-20	+20	-20	+20	μA
	I_{OZ}		-20	+20	-20	+20	μA
Subgroup 2. $T_A = +125^\circ C$	I+		10	40	10	40	mA
	I-		-60	-10	-60	-10	mA
	$R_{IN A}$	Pin 20	3500	8000	3500	8000	Ω
	$R_{IN B}$	Pin 19	1750	4000	1750	4000	Ω
	R_{REF}	Pin 22	1750	3500	1750	3500	Ω
	$V_{REF OUT}$	1mA Load	2.43	2.57	2.43	2.57	V
	$V_{REF LD REG}$	1 to 5mA Load	--	1.5	--	1.5	mV/mA
$V_{REF LN REG}$	$V+ = 4.75V$ to $5.25V$ $V- = -5V$	-600	+600	-600	+600	$\mu V/V$	



Table 3 (con't)

$V_S = \pm 5V, V_{REF} = +2.5V$, unless otherwise specified.

Characteristics	Symbol	Special Conditions	ADC-910/883				Units
			LIMITS A		LIMITS B		
			Min	Max	Min	Max	
Subgroup 2. (Cont'd)	G_{FSE}	(Notes 1,2,3,4)	-6.5	+6.5	-8.5	+8.5	LSB
$T_A = +125^\circ C$	V_{ZSE}	10V and 5V Ranges (Notes 1,3)	-1.0	+1.0	-1.5	+1.5	LSB
	V_{OSE}	10V and 5V Ranges (Notes 2,4)	-1.8	+1.8	-2.3	+2.3	LSB
	INL	(Note 2)	-0.85	+0.85	-1.2	+1.2	LSB
	DNL	(Notes 2,3)	-1.0	+1.0	-1.0	+1.0	LSB
	+ P_{SS}	$V_+ = 4.75V$ to $5.25V$ $V_- = -5V$ (Notes 3,4)	-1.2	+1.2	-1.2	+1.2	LSB
	- P_{SS}	$V_+ = +5V$ $V_- = -5.25V$ to $-4.75V$ (Notes 3,4)	-1.2	+1.2	-1.2	+1.2	LSB
	N		10	--	10	--	Bits
	V_{INH}		2.0	--	2.0	--	V
	V_{INL}		--	0.8	--	0.8	V



Table 3

$V_S = \pm 5V, V_{REF} = +2.5V$, unless otherwise specified.

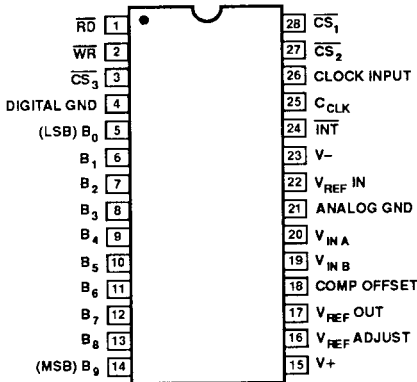
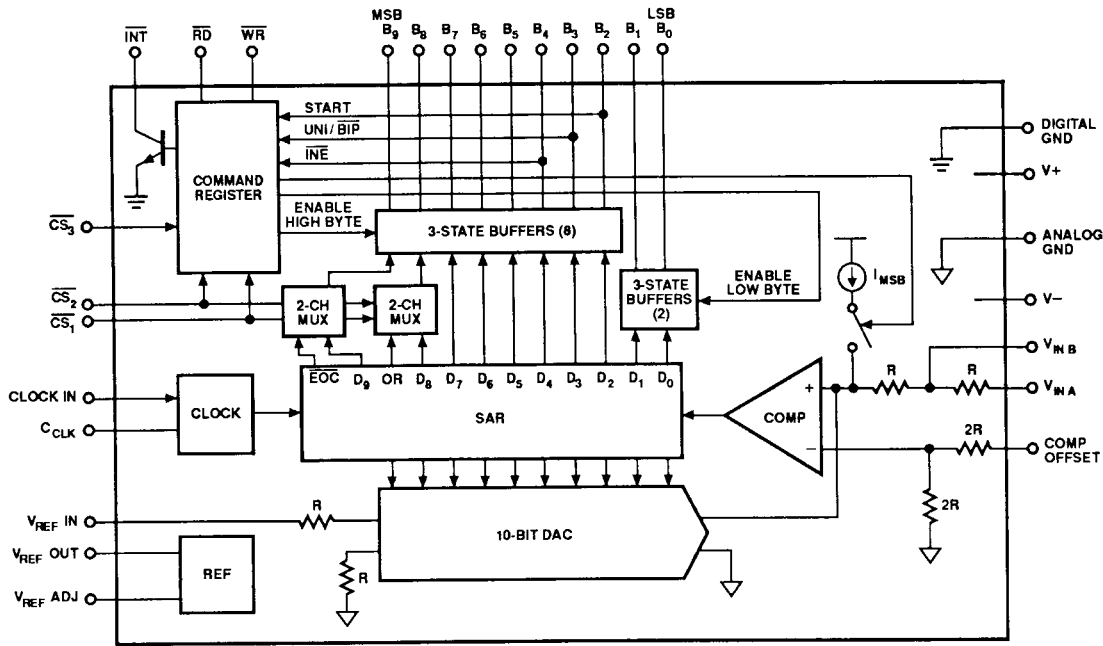
Characteristics	Symbol	Special Conditions	ADC-910/883				Units
			LIMITS A		LIMITS B		
			Min	Max	Min	Max	
Subgroup 2. (Cont'd) $T_A = +125^\circ\text{C}$	V_{OH}	$I_{OH} = -400\mu\text{A}$	2.4	--	2.4	--	V
	V_{OL}	$I_{OL} = 1.6\text{mA}$	--	0.4	--	0.4	V
	I_{INH}		-2	+2	-2	+2	μA
	I_{INL}		-20	+20	-20	+20	μA
	I_{OZ}		-20	+20	-20	+20	μA
Subgroup 3. $T_A = -55^\circ\text{C}$		All Tests, Limits, and Conditions are the same as for Subgroup 2.					
Subgroup 8. $-55^\circ \leq T_A \leq +125^\circ\text{C}$	TCG_{FS}	External REF	--	40	--	50	ppm FS/ $^\circ\text{C}$
		Internal REF (Notes 1,2,3,4)	--	50	--	60	
	TCV_{ZS}	(Notes 2,4)	--	2.0	--	3.0	LSB

NOTES:

1. Tested in 10V unipolar mode @ $F_{CLK} = 0.5\text{MHz}$.
2. Tested in 10V bipolar mode @ $F_{CLK} = 0.5\text{MHz}$.
3. Tested in 5V unipolar mode @ $F_{CLK} = 1.0\text{MHz}$.
4. Tested in 5V bipolar mode @ $F_{CLK} = 0.5\text{MHz}$.



3.2.1 Functional Diagram and Pin Connections



28-PIN HERMETIC DIP
(T-Suffix)



3.2.4 **Microcircuit Group Assignment.** This microcircuit is covered by microcircuit group 57.

4.2 **Life Test/Burn-In Circuit**

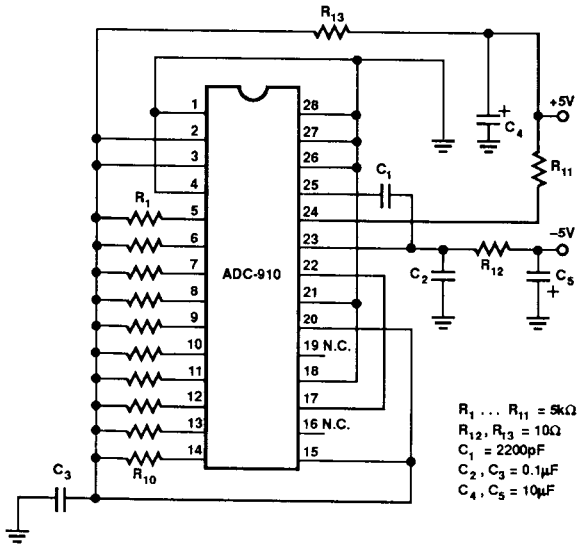
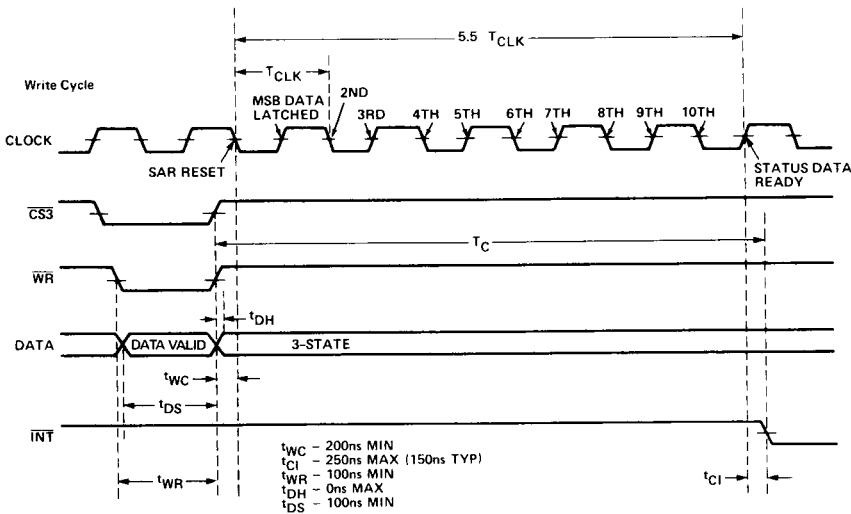




Figure 1.



Define:

$$T_{CLK} = \frac{1}{f_{CLK}} ; T_C = t_{WC} + 5.5 \cdot T_{CLK} + t_{CI}$$

The conversion time (T_C) depends on the user determined f_{CLK} and time placement of the \overline{WR} $\overline{CS3}$ rising edge in relation to the clock falling edge.

For a setup with user determined $t_{WC} = 200ns$, $t_{CI} = 250ns$ (worst case), and clock rates of .5MHz and 1MHz the corresponding T_C will be less than $12\mu s$ and $6\mu s$ respectively.

Example:

$$f_{CLK} = .5MHz, T_{CLK} = 2\mu s : T_C = 11.45\mu s$$

$$f_{CLK} = 1MHz, T_{CLK} = 1\mu s : T_C = 5.95\mu s$$



FIGURE 2: Start Conversion and Operating Mode Selection
(Write Mode \overline{WR} = "Low", CS_3 = "Low")

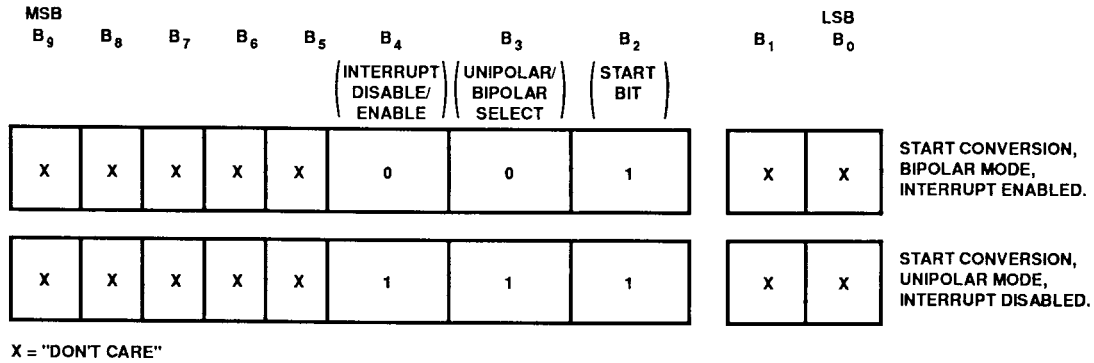


FIGURE 3: Reading Data and Status
(Read Mode \overline{RD} = "Low")

