ANALOG DEVICES Fast, Complete Sampling 12-Bit A/D Converter with Microprocessor Interface

1.1 Scope.

This specification covers the detail requirements for a 12-bit resolution A/D converter with complete microprocessor interface and an on-chip sample-hold amplifier.

1.2 Part Number.

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

Device	Part Number[1]
−1	AD678S(X)/883B
−2	AD678T(X)/883B

NOTE
[1]See paragraph 1.2.3 for package identifier.

1.2.3 Case Outline.

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

(X)	Package	Description
D	D-28	28-Pin DIP
J	J-44	44-Pin JLCC

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

V_{CC} to AGND . . . . . +18 V to −0.3 V
V_{EE} to AGND . . . . . −18 V to +0.3 V
V_{DD} to DGND . . . . . 0 V to +7 V
AGND to DGND . . . . . −1 V to +1 V
V_{CC} to V_{EE} . . . . . +26.4 V to −0.3 V
AIN, REF_{IN} to AGND . . . . . V_{EE} to V_{CC}
Digital Inputs to DGND . . . . . −0.5 V to +7 V
Digital Outputs to DGND . . . . . −0.5 V to V_{DD} + 0.3 V
Power Dissipation . . . . . 1000 mW
Storage Temperature Range . . . . . −65°C to +150°C
Lead Temperature (Soldering 10 sec) . . . . . +300°C

1.5 Thermal Characteristics.

Thermal Resistance θ_{JC} = 4°C/W for J-44; 25°C/W for D-28
θ_{JA} = 80°C/W for J-44; 60°C/W for D-28

Tested in accordance with MIL-STD-750C in still air freely suspended under natural convection conditions.

AD678—SPECIFICATIONS

Table 1.

Test	Symbol	Device	Design Limit @ +25°C	Sub Group 1	Sub Group 2, 3	Sub Group 4	Test Condition[1]	Units
Power Dissipation	P_D	−1, 2	745	745	745		Converting	mW max
Internal Reference Output Voltage	V_{REF}	−1, 2	4.98	4.98	4.98		Bipolar 0.5 mA External Load	+V min
			5.02	5.02	5.02			+V max
Internal Reference Output Current	I_{REF}	−1, 2	1.5	1.5	1.5		Unipolar Mode	mA max
			0.5	0.5	0.5		Bipolar Mode	
High Level Input Voltage	V_{IH}	−1, 2	2.0	2.0	2.0			+V min
Low Level Input Voltage	V_{IL}	−1, 2	0.8	0.8	0.8			+V max
Logic Input Current	I_{IH}	−1, 2	10	10	10		V_{IH} = 5.0 V V_{IL} = 0.0 V	±μA max
High Level Output Voltage	V_{OH}	−1, 2	2.4	2.4	2.4		I_{OH} = −0.5 mA	+V min
Low Level Output Voltage	V_{OL}	−1, 2	0.4	0.4	0.4		I_{OL} = 1.6 mA	+V max
High Z Leakage Current	I_{OZ}	−1, 2	10	10	10		V_{IN} = 0, V_{DD}	±μA max
Power Supply Current	I_{CC}	−1, 2	20	20	20		V_{CC} = 12.6 V, Converting	mA max
	I_{EE}	−1, 2	−34	−34	−34		V_{EE} = −12.6 V, Converting	
	I_{DD}	−1, 2	12	12	12		V_{DD} = +5.5 V, Converting	
Integral Nonlinearity	INL	−1	1	2			Unipolar Mode	±LSB max
		−2	1	2	1	1		
Differential Nonlinearity[2]	DNL	−1, 2	12	12	12		All Codes Tested	Bits min
Unipolar Zero Error	ZE_U	−1	3	10				±LSB max
		−2	3	10		3		
Bipolar Zero Error	ZE_B	−1	5	10				±LSB max
		−2	5	10		5		
Unipolar Zero Error Drift	ZE_UTC	−2			5		w/Internal Reference	±LSB max
Bipolar Zero Error Drift	ZE_BTC	−2			5		w/Internal Reference	±LSB max
Gain Error	GE	−1	6	20			Unipolar & Bipolar Modes	±LSB max
		−2	6	20		6		
Gain Error Drift	GETC	−2			6		Unipolar Mode w/External Reference	±LSB max
Gain Error Drift	GETC	−2			10		Unipolar & Bipolar Mode w/Internal Reference	±LSB max
Power Supply Rejection Ratio	PSRR	−1, 2	2	2			Unipolar Mode[3]	±LSB max

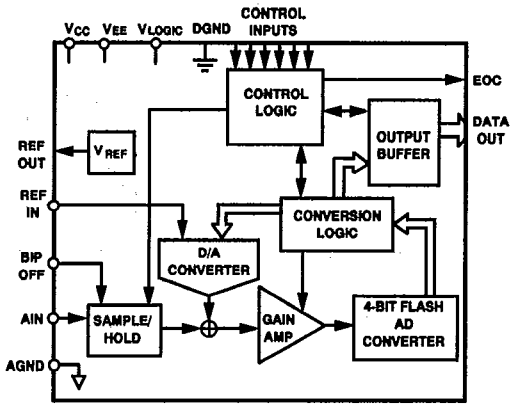
Test	Symbol	Device	Design Limit @ +25°C	Sub Group 4	Sub Group 5, 6	Test Condition[1]	Units
Signal-to-Noise and Distortion	S/(N+D)	−1	70	70	70	Bipolar, f_{IN} = 10.06 kHz	dB min
		−2	72	72	72	Bipolar, f_{IN} = 10.06 kHz	
Total Harmonic Distortion	THD	−1, 2	−80	−80	−80	Bipolar, f_{IN} = 10.06 kHz	dB max
Intermodulation Distortion Second-Order Products	IMD_2	−1, 2	−80	−80	−80	Bipolar, f_A = 9.09 kHz; f_B = 9.58 kHz	dB max
Intermodulation Distortion Third-Order Products	IMD_3	−1, 2	−80	−80	−80	Bipolar, f_A = 9.09 kHz; f_B = 9.58 kHz	dB max

Test	Symbol	Device	Design Limit @ +25°C	Sub Group 9	Sub Group 10, 11	Test Condition[1]	Units
$\overline{SC}$ Delay	t_{SC}	−1, 2	50	50	50	See Figure 1	ns min
Conversion Rate	t_{CR}	−1, 2	5	5	5	See Figure 1	µs max
Convert Pulse Width	t_{CP}	−1, 2	97	97	97	See Figure 1	ns min
Conversion Time	t_C	−1, 2	4.4	4.4	4.4	See Figure 1	µs max
Status Delay	t_{SD}	−1, 2	0	0	0	See Figure 1	ns min
			400	400	400		ns max
Access Time	t_{BA}	−1, 2	100	100	100	See Figures 2, 3, 4	ns max
Float Delay	t_{FD}	−1, 2	10	10	10	See Figures 2, 3, 4	ns min
			80	80	80		ns max
Format Setup	t_{FS}	−1, 2	47	47	47	See Figure 3	ns min
$\overline{OE}$ Delay	t_{OE}	−1, 2	0	0	0	See Figures 3, 4	ns min
Read Pulse Width	t_{RP}	−1, 2	97	97	97	See Figures 3, 4	ns min
Conversion Delay	t_{CD}	−1, 2	150	150	150	See Figures 1, 3, 4	ns min
$\overline{EOCEN}$ Delay	t_{EO}	−1, 2	0	0	0	See Figure 2	ns min
Output Delay	t_{OD}	−1, 2	0	0	0	See Figure 1	ns max

NOTES
[1]V_{CC} = +12 V ± 5%, V_{EE} = −12 V ± 5%, V_{DD} = 5 V ± 10%. See Figures 1, 2, 3, and 4 for timing information.
[2]Minimum resolution for which no missing codes are guaranteed.
[3]Test condition for PSRR, with limit shown as the change from nominal value to each extreme:
+11.4 V ≤ V_{CC} ≤ +12.6 V; V_{EE} = −12 V; V_{DD} = +5 V
−12.6 V ≤ V_{EE} ≤ −11.4 V; V_{CC} = +12 V; V_{DD} = +5 V
+4.5 V ≤ V_{DD} ≤ +5.5 V; V_{CC} = +12 V; V_{EE} = −12 V

3.2.1 Functional Block Diagram and Terminal Assignments

Description	D-28 Pin Description	J-44 Pin Description
$\overline{EOCEN}$	1	1
$\overline{OE}$	2	3
$\overline{SC}$	3	5
$\overline{CS}$	4	6
V_{EE}	5	8
AIN	6	10
AGND	7	11
REFOUT	8	12
REF_{IN}	9	14
BIPOFF	10	15
V_{CC}	11	17
12/$\overline{8}$	12	19
SYNC	13	21
DGND	14	23
DB0 ($\overline{HBE}$)	15	25
DB1 (R/$\overline{L}$)	16	26
DB2	17	27
DB3	18	30
DB4	19	31
DB5	20	33
DB6	21	34
DB7	22	35
DB8	23	36
DB9	24	37
DB10	25	39
DB11	26	40
EOC	27	42
V_{DD}	28	43

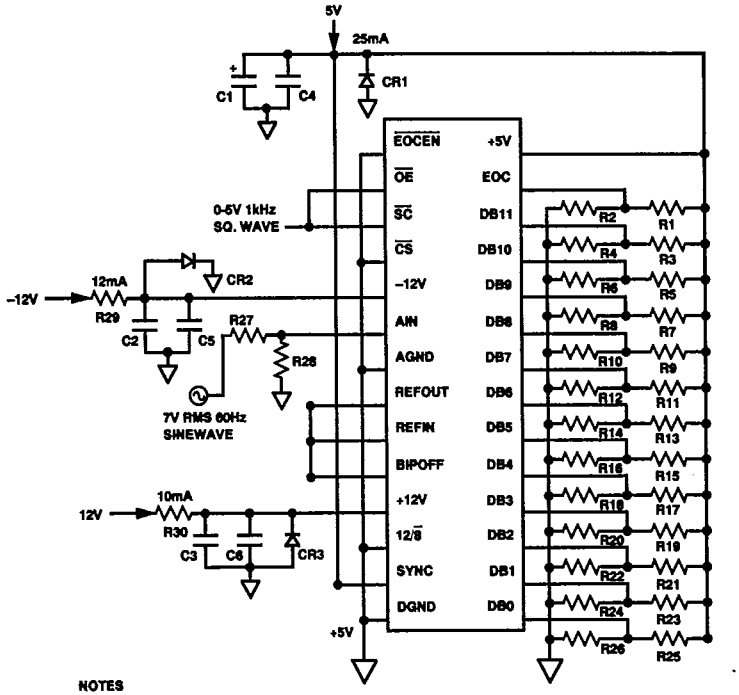


3.2.4 Microcircuit Technology Group

This circuit is covered by technology group (57).

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).



NOTES
1. C1, C2, C3 ARE 47μF CAPACITORS RATED AT 35V, 125°C.
2. C4, C5, C6 ARE 0.1μF CAPACITORS RATED AT 50V, 125°C.
3. CR1, CR2, CR3 ARE MRB20 DIODES.
4. R1-R26 ARE 3kΩ RESISTOR PACKS.
5. ALL CURRENTS SHOWN ARE MAXIMUM PER DEVICE.
6. R27, R28 ARE 10kΩ 1% 1/4 WATT METAL FILM RESISTORS.
7. R29 AND R30 ARE 1Ω 2 WATT GLASS RESISTORS.

Burn-In Circuit

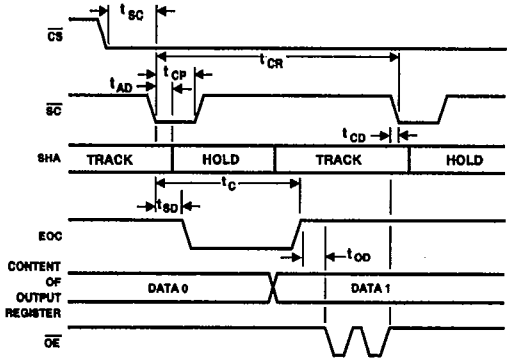


Figure 1. Conversion Timing

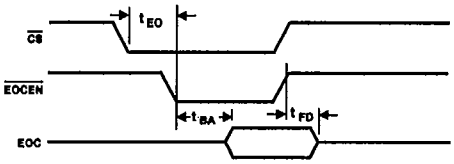


Figure 2. EOC Timing

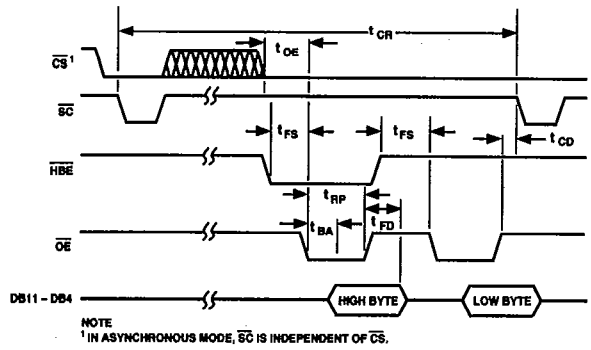


Figure 3. Output Timing, 8-Bit Read Mode

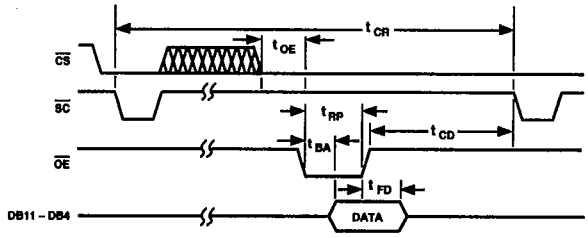


Figure 4. Output Timing, 12-Bit Read Mode

TEST	V_{CP}	C_{OUT}
ACCESS TIME HIGH Z TO LOGIC LOW	5V	100pF
FLOAT TIME LOGIC HIGH TO HIGH Z	0V	10pF
ACCESS TIME HIGH Z TO LOGIC HIGH	0V	100pF
FLOAT TIME LOGIC LOW TO HIGH Z	5V	10pF

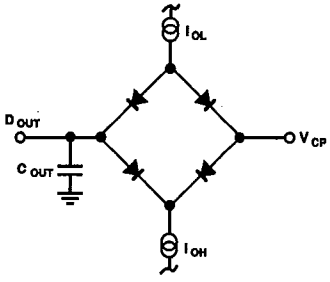


Figure 5. Load Circuit for Bus Timing Specifications