

FEATURES

- 8-Bit flash A/D converter
- 20MHz sampling rate
- Complete support circuitry
- Low power, 1.5W
- 7MHz full power bandwidth
- Sample-hold not required
- Three-state outputs
- MIL-STD-883 versions



GENERAL DESCRIPTION

The ADC-228 combines analog front-end circuitry and a flash A/D converter to digitize high-speed analog signals at a rate of 20 million samples per second. The ADC-228 contains an 8-bit, 20MHz, flash A/D, a wideband analog input buffer, a precision voltage reference, temperature compensation circuitry, reference trims, and a three-state output buffer in a 24-pin package.

The ADC-228 offers significant savings by combining all of the circuitry in a single package. Valuable board real estate is saved, and design time and manufacturing costs are reduced.

The ADC-228 is housed in a 24-pin ceramic DDIP package and is available in the commercial, 0 to +70°C, or military, -55 to +125°C, temperature ranges. A MIL-STD-883 version is also available. Operation is from $\pm 15V$ and +5V power supplies.

INPUT/OUTPUT CONNECTIONS

PIN	FUNCTION	PIN	FUNCTION
1	+5V SUPPLY	24	BIT 8 (LSB)
2	GROUND	23	BIT 7
3	+5V REFERENCE OUT	22	BIT 6
4	GROUND	21	BIT 5
5	ANALOG INPUT	20	NO CONNECTION
6	GROUND	19	+15V SUPPLY
7	GROUND	18	CLOCK INPUT
8	NLINV	17	BIT 4
9	NMINV	16	BIT 3
10	-15V SUPPLY	15	BIT 2
11	CS1	14	BIT 1 (MSB)
12	CS1	13	NO CONNECTION

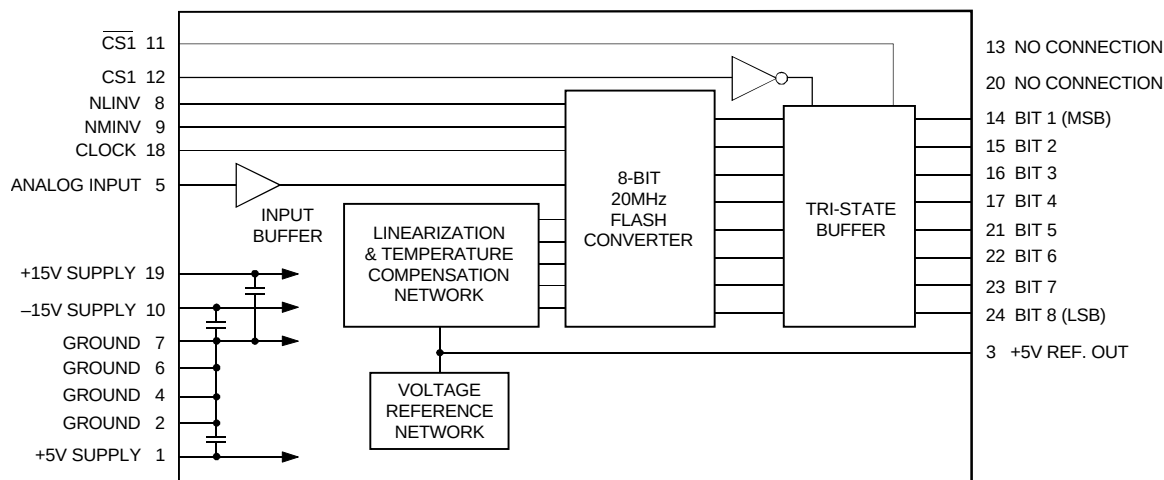


Figure 1. Functional Block Diagram

ABSOLUTE MAXIMUM RATINGS

PARAMETER	LIMITS
Power Supply Voltage, Pin 19 Pin 10	Pin 1 –0.5 to +7V –0.3 to +18V +0.3 to –18V
Digital Inputs, Pins 8,9,11,12,18	–0.5 to +5.5V
Analog Input, Pin 5	–6 to +7.5V
Digital Outputs	–0.5 to +5.5V (short circuit protected to ground)
Lead Temp. (10 seconds)	+300°C

FUNCTIONAL SPECIFICATIONS

(Apply over the operating temperature range with 20MHz clock and $\pm 15V$ and +5V power supply voltages, unless otherwise specified.)

ANALOG INPUTS	MIN.	TYP.	MAX.	UNITS
Single-Ended, Non-Isolated Input Range, dc-20MHz	0	—	+5.0	Volts
Input Resistance	2.45	2.5	2.55	k Ω
Input Capacitance	—	5	10	pF
DIGITAL INPUTS				
Logic Levels	+2.0	—	—	Volts
Logic 1	—	—	+0.8	Volts
Logic 0	—	—	—	—
Logic Loading	—	—	+160	μA
Logic 1	—	—	–0.5	mA
Logic 0	—	—	—	—
Clock Pulse Widths	25	—	—	ns
"High"	19	—	—	ns
"Low"	—	—	—	—
DIGITAL OUTPUTS				
Coding	Straight bin., comp. bin., two's comp., comp. two's comp. 8 bits			
Resolution	—	—	—	—
Logic Levels	+2.4	—	—	Volts
Logic 1	—	—	+0.4	Volts
Logic 0	—	—	—	—
Logic Loading	—	—	–1	mA
Logic 1	—	—	+1	mA
Logic 0	—	—	—	—
Output Data Valid Delay	—	30	40	ns
From Rising Edge	—	—	—	—
Output Hold Time	5	—	—	ns
PERFORMANCE				
Sampling Rate ①	20	—	—	MHz
Differential Linearity ②	—	± 0.5	± 0.75	LSB
Code Transitions	—	± 0.25	± 0.5	LSB
Code Centers	—	—	—	—
Integral Linearity, +25°C	—	± 0.5	± 0.75	LSB
End-point	—	± 0.35	± 0.5	LSB
Best-fit Line	—	—	± 1	LSB
Over Temperature End-point	—	—	± 1	LSB
Best-fit Line	—	—	± 1	LSB
Zero-Scale Offset	—	—	± 0.5	LSB
Code "0" to "1" Transition	—	± 0.5	± 1.5	LSB
+25°C	—	± 0.5	± 1.5	LSB
–55 to +125°C	—	± 0.5	± 1.5	LSB
Gain error	—	± 0.5	± 1.5	LSB
Full Scale Absolute Accuracy	—	± 0.5	± 1.5	LSB
Differential Gain ③	—	2	—	%
Differential Phase ③	—	1	—	deg.
Aperture Delay	—	8	—	ns
Aperture Jitter	—	50	—	ps
No Missing Codes	Over the operating temperature range			
Power Supply Rejection	$\pm 0.02\%$ FSR/%V _S maximum			

DYNAMIC PERFORMANCE	MIN.	TYP.	MAX.	UNITS
Total Harm. Distortion, –0.5dB	—	–55	–53	dB
DC to 2.5 MHz	—	–50	–48	dB
2.5 MHz to 5 MHz	—	–39	–36	dB
5 MHz to 10 MHz	—	—	—	—
Signal-to-Noise Ratio and Distortion, –0.5dB	44	49	—	dB
DC to 2.5 MHz	43	46	—	dB
2.5 MHz to 5 MHz	35	38	—	dB
5 MHz to 10 MHz	—	—	—	—
Signal-to-Noise Ratio w/o Distortion, –0.5 dB	45	48	—	dB
DC to 2.5 MHz	45	48	—	dB
2.5 MHz to 5 MHz	42	45	—	dB
5 MHz to 10 MHz	—	—	—	—
Effective Bits, –0.5dB	7.1	7.75	—	Bits
DC to 2.5 MHz	6.9	7.4	—	Bits
2.5 MHz to 5 MHz	5.6	6.1	—	Bits
5 MHz to 10 MHz	—	—	—	—
Input Bandwidth	7	—	—	MHz
Full Power	40	—	—	MHz
Small Signal (–20dB)	—	—	—	—
POWER SUPPLY				
Power Supply Range	+11	+15	+15.75	Volts
+15V Supply	–11	–15	–15.75	Volts
–15V Supply	+4.75	+5	+5.25	Volts
+5V Supply	—	—	+30	mA
Power Supply Current	—	—	–10	mA
+15V Supply	—	—	+230	mA
–15V Supply	—	—	—	—
+5V Supply	—	1.4	1.65	Watts
Power Dissipation	—	1.6	1.85	Watts
$\pm 12V$, +5V Nominal	—	1.5	1.75	Watts
Over full supply range	—	—	—	—
$\pm 15V$, +5V Nominal	—	—	—	—
PHYSICAL/ENVIRONMENTAL				
Operating Temp. Range, Case	0 to +70°C			
ADC-228MC	–55 to +125°C			
ADC-228MM, ADC-228/883	–65 to +150°C			
Storage Temp. Range	24-pin, ceramic DDIP			
Package Type	0.3 ounces (8.5 grams)			
Weight	—			

Footnotes:

- ① At full power input and chip selects enabled.
- ② See Technical Note 3.
- ③ For 10-step, 40 IRE NTSC ramp test.

TECHNICAL NOTES

1. Rated performance requires using good high-frequency techniques. The analog and digital ground pins are connected to each other internally. Avoid ground related problems by connecting the grounds to one point, the ground plane beneath the converter. Due to the inductance and resistance of the power supply return paths, return the analog and digital ground separately to the power supplies.
2. Bypass all the analog and digital supplies and the +5V REFERENCE (pin 3) to ground with a 4.7μF, 25V tantalum electrolytic capacitor in parallel with a 0.1μF ceramic capacitor.
3. DATEL uses conservative definitions when specifying integral linearity (end-point) and differential linearity (code transition). The specifications using the less conservative definitions have also been provided as a comparative specification for products specified this way.
4. Single conversions (one-shot mode) would require another clock edge to read out data. Users desiring to provide just a single clock pulse could use the circuit shown in Figure 2 to obtain the data.

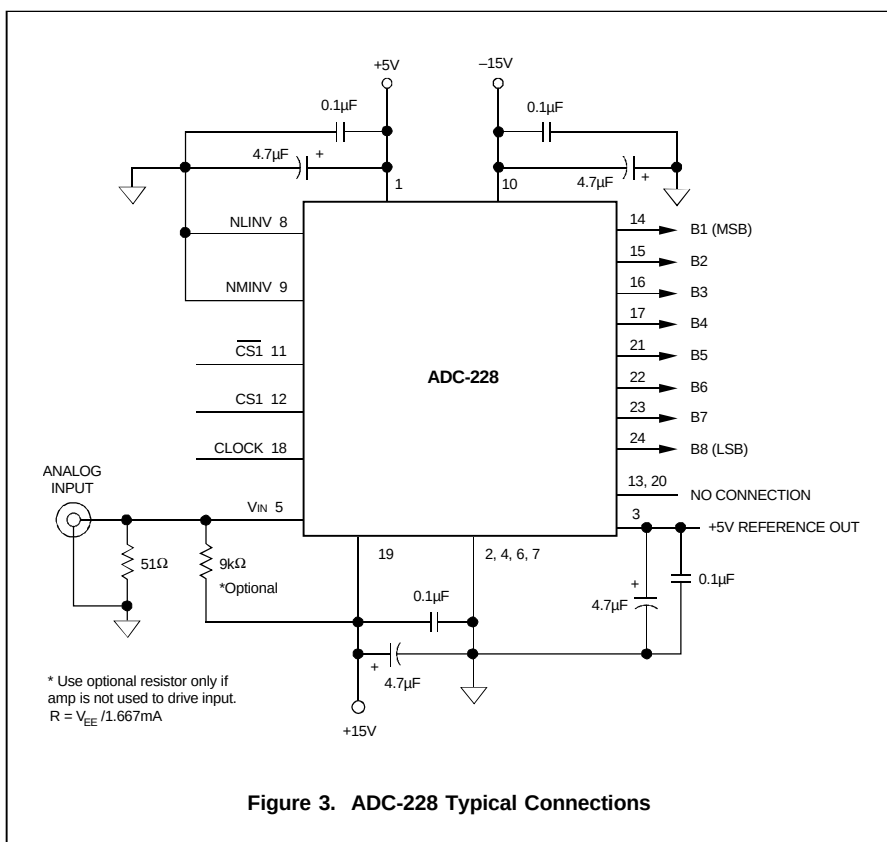
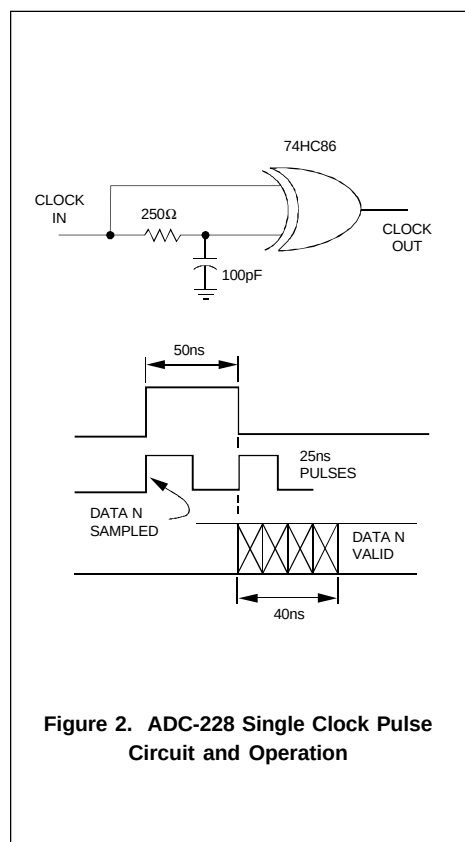


Table 1. ADC-228 Unipolar Output Coding

ANALOG INPUT	CODE	STRAIGHT BIN. NMINV = 0 NLINV = 0	COMP. BIN. NMINV = 1 NLINV = 1
+4.96V	+FS - 1 LSB	1111 1110	0000 0001
+3.75V	+ 3/4 FS	1100 0000	0011 1111
+2.50V	+ 1/2 FS	1000 0000	0111 1111
+1.25V	+ 1/4 FS	0100 0000	1011 1111
+0.02V	+ 1 LSB	0000 0001	1111 1110
0.00V	ZERO	0000 0000	1111 1111

Table 2. ADC-228 Bipolar Output Coding
(Assumes analog input is externally offset)

ANALOG INPUT	CODE	TWO'S COMP. NMINV = 1 NLINV = 0	COMP. TWO'S COMP. NMINV = 0 NLINV = 1
+2.480V	+FS - 1 LSB	0111 1111	1000 0000
+1.250V	+1/2 FS	0100 0000	1011 1111
+0.020V	+1 LSB	0000 0001	1111 1110
+0.000V	ZERO	0000 0000	1111 1111
-1.250V	-1/2 FS	1100 0000	0011 1111
-2.480V	-FS + 1 LSB	1000 0001	0111 1110
-2.500V	-FS	1000 0000	0111 1111

Table 3. Chip Select Truth Table

CS1 Pin 12	$\overline{\text{CS1}}$ Pin 11	Bits 1-8
0	0	Three State Mode
0	1	Three State Mode
1	0	Data Outputted
1	1	Three State Mode

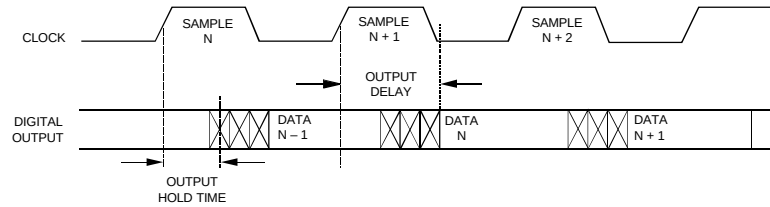
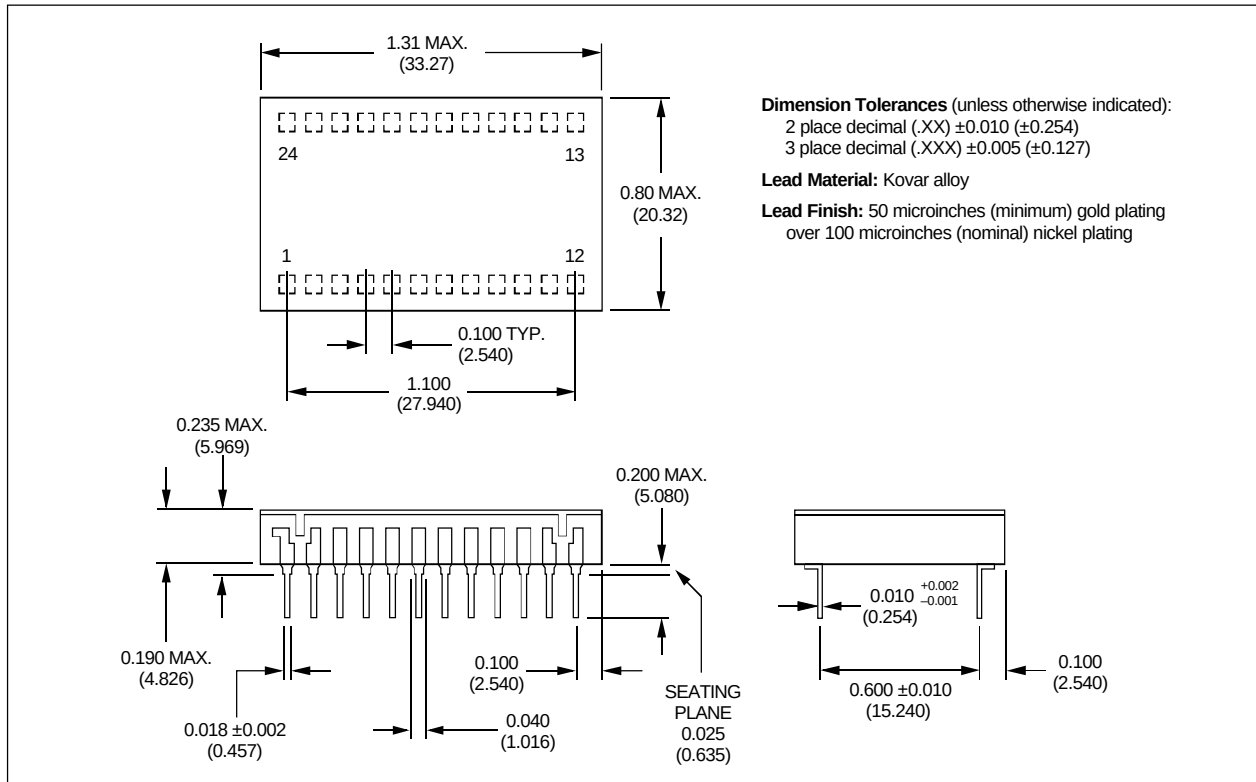


Figure 4. ADC-228 Timing Diagram

MECHANICAL DIMENSIONS INCHES (mm)



ORDERING INFORMATION

MODEL	TEMPERATURE RANGE
ADC-228MC	0 to +70°C
ADC-228MM	-55 to +125°C
ADC-228/883	-55 to +125°C

Receptacle for PC board mounting can be ordered through AMP Inc., part # 3-331272-8 (component lead socket), 24 required. Contact DATEL for 883 product specifications