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ADS-21PC

Low-Power, 12-Bit, 1.3 MHz Sampling A/D Converter

FEATURES

- **12-Bit resolution**
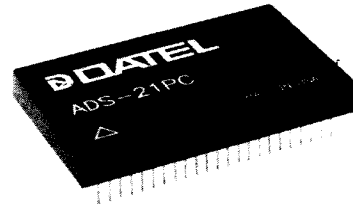- **1.3 MHz throughput rate**
- **S/H included**
- **Single 46-pin DIP**

GENERAL DESCRIPTION

DATEL's ADS-21PC Sampling Converter combines a 12-bit A/D and a S/H in one space-saving package. Designed and manufactured at DATEL's modern, certified hybrid assembly facility using state-of-the-art integrated circuits, the ADS-21PC provides the highest quality and performance for signal processing applications.
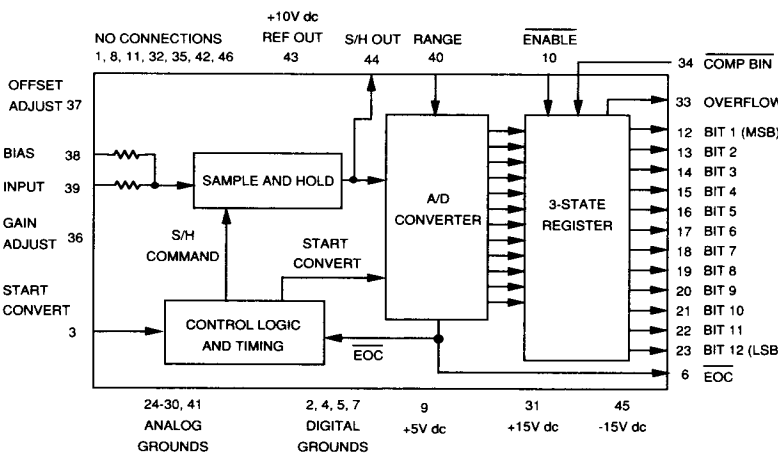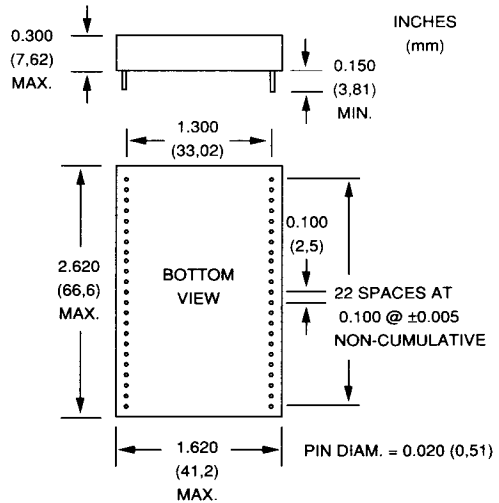
TECHNICAL NOTES

1. Use external potentiometers to remove system errors or the small initial errors to zero. Use a 20K trimming potentiometer for gain adjustment with the wiper tied to pin 36 (ground pin 36 for operation without adjustments). Use a 20K trimming potentiometer with the wiper tied to pin 37 for zero/offset adjustment (leave pin 37 open for operation without adjustment).

2. Rated performance requires using good high frequency circuit board layout techniques. The analog and digital grounds are connected internally. Avoid ground-related problems by connecting the digital and analog 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. This prevents contamination of the analog ground by noisy digital ground currents.

MECHANICAL DIMENSIONS

INCHES (mm)

0.300 (7,62) MAX.
0.150 (3,81) MIN.
1.300 (33,02)
2.620 (66,6) MAX.
BOTTOM VIEW
0.100 (2,5)
22 SPACES AT 0.100 @ ±0.005 NON-CUMULATIVE
1.620 (41,2) MAX.
PIN DIAM. = 0.020 (0,51)

INPUT/OUTPUT CONNECTIONS

PIN	FUNCTION	PIN	FUNCTION
1	N/C	24	ANA GND
2	DIG GND	25	ANA GND
3	START CONVERT	26	ANA GND
4	DIG GND	27	ANA GND
5	DIG GND	28	ANA GND
6	EOC	29	ANA GND
7	DIG GND	30	ANA GND
8	N/C	31	+15V
9	+5V	32	N/C
10	ENABLE	33	OVERFLOW
11	N/C	34	COMP BIN
12	BIT 1 (MSB)	35	N/C
13	BIT 2	36	GAIN ADJUST
14	BIT 3	37	OFFSET ADJUST
15	BIT 4	38	BIAS
16	BIT 5	39	ANALOG INPUT
17	BIT 6	40	RANGE
18	BIT 7	41	ANA GND
19	BIT 8	42	N/C
20	BIT 9	43	+10V REF OUT
21	BIT 10	44	S/H OUT
22	BIT 11	45	-15V
23	BIT 12 (LSB)	46	N/C

ADS-21PC

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ABSOLUTE MAXIMUM RATINGS

PARAMETERS	LIMITS
+15V Supply (Pin 31)	-0.3 to +18V dc
-15V Supply (Pin 45)	+0.3 to -18V dc
+5V Supply (Pin 9)	-0.5 to +7V dc
Digital Inputs (Pins 3,10,34)	-0.3 to +5.5V dc
Analog Input (Pins 38, 39)	-15 to +15V dc
Lead Temp. (10 Sec.)	300 °C

FUNCTIONAL SPECIFICATIONS

Apply over the operating temperature range and at ±15V dc and +5V dc unless otherwise specified.

INPUTS	MIN.	TYP.	MAX.	UNITS
Input Voltage Ranges	–	0 to +10	–	V dc
	–	0 to -5V	–	V dc
	–	0 to -10	–	V dc
	–	±10, ±5	–	V dc
Input Impedance				
0 to -10V, 0 to +10V,				
±10V	–	1	–	KΩ
0 to -5V, ±5V	–	500	–	Ohms
Logic Levels				
Logic 1	2.0	–	–	V dc
Logic 0	–	–	0.8	V dc
Logic Levels				
Logic 1	–	–	5	µA
Logic 0	–	–	-200	µA
OUTPUTS				
Output Coding Options		straight binary		
		offset binary		
		complementary binary		
		complementary offset binary		
Logic Levels				
Logic 1	2.4	–	–	V dc
Logic 0	–	–	0.4	V dc
Logic Loading				
Logic 1	–	–	-160	µA
Logic 0	–	–	6.4	mA
Internal Reference (Pin 43)				
Voltage, +25 °C	9.98	10.0	10.02	V dc
Drift	–	±5	±30	ppm/ °C
External Current (Pin 43)	–	–	1.5	mA
DYNAMIC PERFORMANCE				
Feedthrough Rejection	–	-74	–	dB
SNR w/o distortion, -0.5 dB				
dc to 100 kHz	-69.0	-71	–	dB
100 KHz to 500 KHz	-67	-70	–	dB
SNR with distortion, -0.5 dB				
dc to 100 kHz	-68.0	-71	–	dB
100 KHz to 500 KHz	-66	-70	–	dB
Effective Bits				
dc to 100 kHz	11	11.5	–	Bits
100 KHz to 500 KHz	10.7	11.3	–	Bits
Inband Harmonics ①				
dc to 100 kHz	-72	-80	–	FS -dB
100 to 500 KHz	-70	-75	–	FS,-dB
Frequency Response				
Small Signal (-3 dB)	–	16	–	MHz
Slew Rate	–	300	–	V/µS
Aperture Delay Time	–	–	±16	nS
Aperture Uncertainty (Jitter)	–	–	±50	pS
Settling Time				
10V to ±0.01% FS				
(±1mV)	–	60	100	nS

DYNAMIC PERFORM. CONT.	MIN	TYP	MAX	UNITS
Acquisition Time				
10V step to ±1.0 mV				
(0.01% FS)				
+25 °C	–	145	180	nS
0 to +70 °C	–	165	220	nS
PERFORMANCE, ±10V RANGE				
Integral Nonlinearity				
0 to +70 °C	–	–	±0.0125	%FSR±1/2LSB
Differential Nonlinearity				
0 to +70 °C	–	–	±0.0125	%FSR±1/2LSB
FS Absol. Accuracy				
+25 °C	–	±5	±12	LSB
0 to +70 °C	–	±6	±15	LSB
Unipolar Zero Error				
+25 °C	–	±2	±5	LSB
Unipolar Zero Tempco	–	±13	±25	ppm/ °C
Bipolar Zero Error	–	–	±5	LSB
Bipolar Zero Tempco	–	±13	±25	ppm/ °C
Bipolar Offset Error				
+25 °C	–	±2	±8	LSB
Bipolar Offset Tempco	–	±17	±40	ppm/ °C
Gain Error, +25 °C	–	±3	±8	LSB
Gain Tempco	–	±18	±40	ppm/ °C
Throughput Rate				
+25 °C	1.3	–	–	MHz
0 to +70 °C	1.1	–	–	MHz
No Missing Codes (12 bits)		Over the operating temp. range.		
POWER SUPPLY REQUIREMENTS				
Power Supply Range				
+15V dc Supply	+14.25	+15	+15.75	V dc
-15V dc Supply	-14.25	-15	-15.75	V dc
+5V dc Supply	+4.75	+5	+5.25	V dc
Power Supply Current				
+15V Supply	–	+50	+65	mA
-15V Supply	–	-65	-72	mA
+5V Supply*	–	+80	+95	mA
Power Dissipation	–	2.1	2.5	Watts
Power Supply Rejection	–	0.01	0.05	%FSR/%V
PHYSICAL-ENVIRONMENTAL				
Operating Temp. Range	0	–	+70	°C
Storage Temp. Range	-65	–	+125	°C
Package Type		46-pin DIP		
Pins		0.010 x 0.018 copper alloy		
Weight		1.25 Oz. (35 g) max.		

*+5V power usage at 1 TTL logic loading per data output bit.

① Same specification values apply for Total Harmonic Distortion (-0.5 dB below FS).

TECHNICAL NOTES CONT.

3. Bypass all the analog and digital supplies and the +10V reference (pin 43) to ground with a 4.7 µF, 25V tantalum electrolytic capacitor in parallel with a 0.1 µF ceramic capacitor. Bypass the +10V reference (pin 43) to analog ground (pin 41).

4. The COMP BIN input (pin 34) allows selection of binary/offset binary or complementary binary/complementary offset binary. Refer to Table 3 for the desired coding selection. Pin 34 has an internal pull-up resistor and is TTL-compatible for those users desiring logic control of this function.

5. The internal Sample/Hold control signal goes low following the rising edge of a start convert pulse and high 65 nanoseconds minimum before EOC goes low. This S/H low signal indicates that the converter can accept a new analog input.

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Table 1. Input Connections

Input Voltage Range	Connect Input Pin 38 to	Connect Pin 40 (Range) to
0 to -5V	39	44
0 to -10V	–	44
0 to +10V	Ext. -10V Ref.*	44
±5V	39	43
±10V	–	43

*May be referenced to +10V Ref. (Pin 43)

Table 2. Zero and Gain Adjust

FSR	Zero Adjust +1/2 LSB	Gain Adjust +FS - 1 1/2 LSB
0 to -5V	-0.61 mV	-4.9982V
0 to -10V	-1.22 mV	-9.9963V
0 to +10V	+1.22 mV	+9.9963V
±10V dc	+2.44 mV	+9.9927V dc
±5V dc	+1.22 mV	+4.9963V dc

CALIBRATION PROCEDURE

1. Connect the converter per Figure 3 and Tables 1 and 3 for the appropriate full-scale range (FSR) and coding options. Apply a pulse of 100 nanoseconds minimum to the START CONVERT input (pin 3) at a rate of 500 KHz. This rate chosen to reduce flicker if LED's are used on the outputs for calibration purposes.

2. Zero Adjustment
Apply a precision voltage reference source between the analog input (pin 39) and ground (pin 24). Adjust the output of the reference source per Table 2. For Unipolar operation adjust the zero trimming potentiometer so that the output code flickers equally between 0000 0000 0000 and 0000 0000 0001 or between 1111 1111 1111 and 1111 1111 1110. Refer to Table 4.

For bipolar operation, adjust the potentiometer until the displayed code flickers equally between 1000 0000 0000 and 1000 0000 0001 or between 0111 1111 1111 and 0111 1111 1110. Refer to Table 5.

3. Full-Scale Adjustment
Set the output of the voltage reference used in step 2 to the value shown in Table 2. Adjust the gain trimming potentiometer so that the output code flickers equally between 1111 1111 1110 and 1111 1111 1111 or between 0000 0000 0001 and 0000 0000 0000 depending on the output coding selected.

4. To confirm proper operation of the device, vary the precision reference voltage source to obtain the output coding listed in Tables 4 and 5.
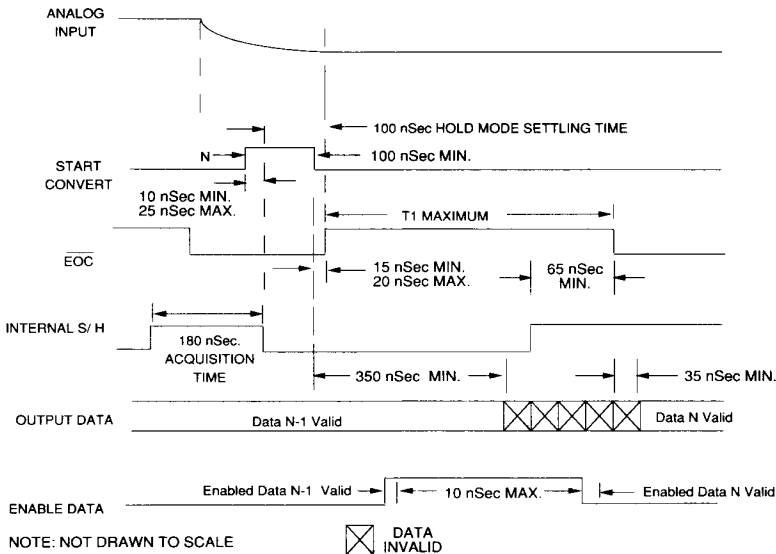
T1 Values

	Temperature	
	+25 °C	0 to +70 °C
Conversion Time	530 nSec.	590 nSec.

NOTE: Timing cited is guaranteed by design and applies over the operating temperature and power supply ranges.

NOTE: NOT DRAWN TO SCALE

Table 3. Input Range/Output Selection

Input Voltage Range	Binary/ Offset Binary Connect Pin 34 to	Comp. Binary/ Comp.Offset Binary Connect Pin 34 to
0 to -5V	–	2,4,5,7
0 to -10V	–	2,4,5,7
0 to +10V	2,4,5,7	–
±5V	2,4,5,7	–
±10V	2,4,5,7	–

Table 4. Output Coding for Unipolar Operation

Unipolar Scale	Input Ranges Volts dc			Output Coding	
	0 to -5V	0 to -10V	0 to +10V	Straight Binary MSB LSB	Comp. Binary MSB LSB
+FS - 1LSB	-4.998V	-9.9976V	+9.9976V	1111 1111 1111	0000 0000 0000
7/8 FS	-4.375V	-8.750V	+8.750V	1110 0000 0000	0001 1111 1111
3/4 FS	-3.750V	-7.500V	+7.500V	1100 0000 0000	0011 1111 1111
1/2 FS	-2.500V	-5.00V	+5.00V	1000 0000 0000	0111 1111 1111
1/4 FS	-1.250V	-2.500V	+2.500V	0100 0000 0000	1011 1111 1111
1/8 FS	-0.625V	-1.250V	+1.250V	0010 0000 0000	1101 1111 1111
1 LSB	-0.0012V	-0.0024V	+0.0024V	0000 0000 0001	1111 1111 1110
0	0.0000V	0.0000V	0.0000V	0000 0000 0000	1111 1111 1111

**Figure 3.
Typical ADS-21PC Connections**

Table 5. Output Coding for Bipolar Operation

Bipolar Scale	Input Ranges Volts dc		Output Coding	
	±5V	±10V	Offset Binary MSB LSB	Comp. Offset Binary MSB LSB
+FS - 1 LSB	+4.9976V	+9.9951V	1111 1111 1111	0000 0000 0000
+3/4 FS	+3.7500V	+7.5000V	1110 0000 0000	0001 1111 1111
+1/2 FS	+2.5000V	+5.0000V	1100 0000 0000	0011 1111 1111
0	0.0000V	0.0000V	1000 0000 0000	0111 1111 1111
-1/2 FS	-2.5000V	-5.0000V	0100 0000 0000	1011 1111 1111
-3/4 FS	-3.7500V	-7.5000V	0010 0000 0000	1101 1111 1111
-FS +1LSB	-4.9976V	-9.9951V	0000 0000 0001	1111 1111 1110
-FS	-5.0000V	-10.0000V	0000 0000 0000	1111 1111 1111
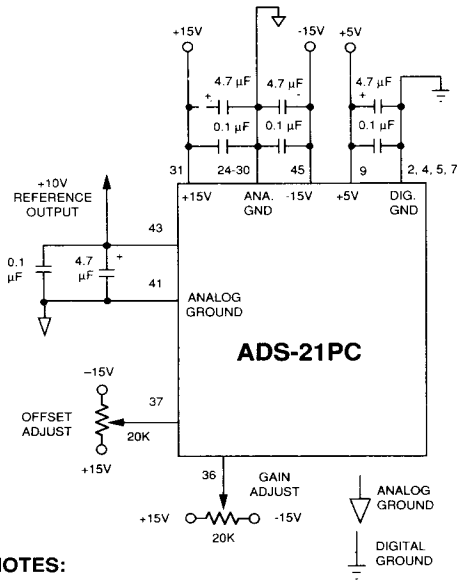
NOTES:

1. Pins 2, 4, 5, 7, 24-30, and 41 must be connected to the ground plane as close as possible to the case.

2. Pins 1, 8, 11, 32, 35, 42, and 46 have no internal connections.

ORDERING INFORMATION	
MODEL NO.	TEMP. RANGE
ADS-21PC	0 to +70 °C

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