

# ADVANCED ANALOG

A Division of intech

## ADC5200 SERIES

### DESCRIPTION

The ADC5200 Series devices are successive approximation 12-bit A/D converters with 13 $\mu$ sec or 50  $\mu$ sec conversion time. These devices are laser trimmed for ultra accuracy and reliability and require no external adjustment.

These devices are available in four input voltage ranges:  $\pm 5V$ ,  $\pm 10V$ , 0 to +10V and -10V to 0. Models are available complete with a highly accurate and stable internal reference, or for use with an even higher quality external reference. All devices in this series have  $\pm 1/2$  LSB linearity guaranteed over the full operating temperature range.

The ADC5200 Series feature low power consumption — 590 mW maximum, serial or parallel output data and TTL compatibility.

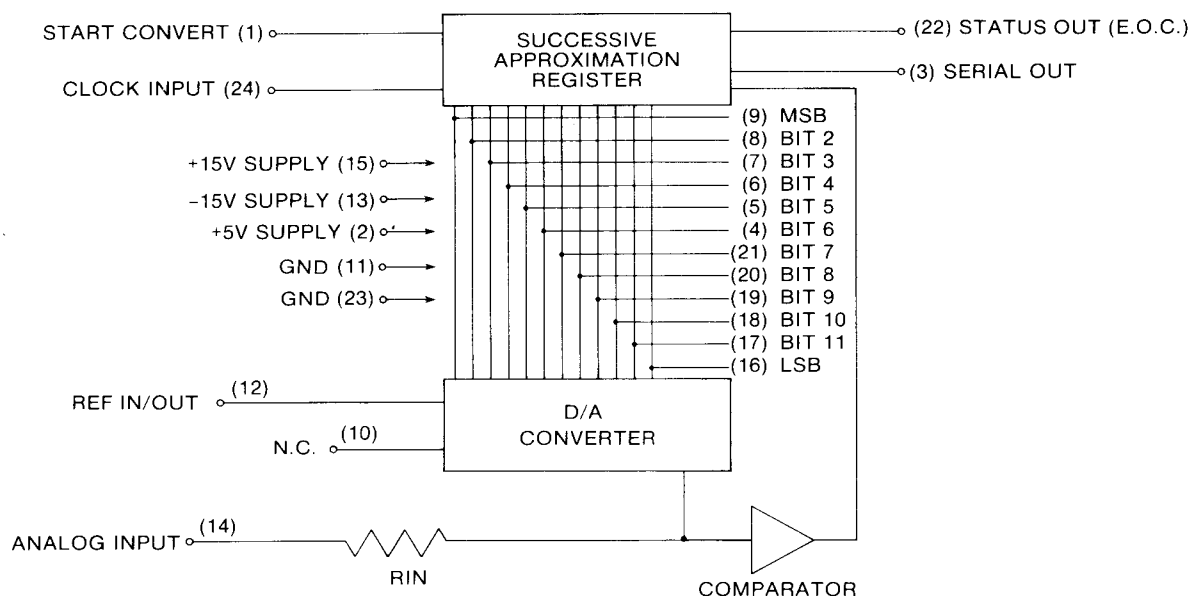
All models are available in military, industrial or commercial temperature ranges. Devices with military screening are also available.

### HIGH SPEED 12-BIT A/D CONVERTERS

### FEATURES

- 13 $\mu$ sec conversion time - ADC5210
- 50 $\mu$ sec conversion time - ADC5200
- Low power consumption - 590 mW max.
- Small, 24-pin cerdip package
- Adjustment free operation
- Laser trimmed for accuracy and stability
- TTL/CMOS compatible
- Full mil operation

### BLOCK DIAGRAM



# SPECIFICATIONS

## ABSOLUTE MAXIMUM RATINGS

Operating Temperature Range:	0°C to +70°C -25°C to +85°C -55°C to +125°C -65°C to +150°C
Storage Temperature Range	+18V -18V
Positive Supply, Pin 15	-0.5V to +7V
Negative Supply, Pin 13	+25V
Logic Supply, Pin 12	-0.5V to +5.5V
Analog Input, Pin 14	Logic Supply
Digital Inputs, Pin 1, 24	0 to -15V
Digital Outputs	
Reference Input	

@ +25°C, ±15V +5V supply voltages, ±5% unless otherwise noted.

External reference devices  $V_{Ref} = -10.000V$ , unless otherwise noted.

ANALOG INPUTS		P/N (int. ref.)		P/N (ext. ref.)			
Input Range (Input Impedance) -5V to +5V (5K $\Omega$ ) -10V to +10V (10K $\Omega$ ) 0 to -10V (5K $\Omega$ ) 0 to +10V (5K $\Omega$ )		ADC52X1 ADC52X2 ADC52X0 ADC52X6		ADC52X4 ADC52X5 ADC52X3 ADC52X7			
TRANSFER CHARACTERISTICS		TYP.	MAX.	TYP.	MAX.	UNITS	
Linearity Error <sup>1</sup> +25°C 0°C to +70°C -55°C to +125°C		$\pm \frac{1}{4}$ $\pm \frac{1}{4}$	$\pm \frac{1}{2}$ $\pm \frac{1}{2}$ $\pm \frac{1}{2}$	$\pm \frac{1}{4}$ $\pm \frac{1}{4}$	$\pm \frac{1}{2}$ $\pm \frac{1}{2}$ $\pm \frac{1}{2}$	LSB LSB LSB LSB	
Differential Linearity Error							
No Missing Codes		Guaranteed over temperature					
Full scale Absolute Accuracy Error <sup>2,3</sup> +25°C 0°C to +70°C -55°C to +125°C		$\pm 0.025$ $\pm 0.2$	$\pm 0.05$ $\pm 0.4$ $\pm 0.4$	$\pm 0.025$ $\pm 0.05$	$\pm 0.05$ $\pm 0.1$ $\pm 0.1$	% FSR % FSR % FSR	
Zero Error: +25°C 0°C to +70°C -55°C to +125°C		$\pm 0.01$ $\pm 0.025$	$\pm 0.025$ $\pm 0.05$ $\pm 0.05$	$\pm 0.01$ $\pm 0.025$	$\pm 0.025$ $\pm 0.05$ $\pm 0.05$	% FSR % FSR % FSR	
Gain Error		$\pm 0.025$		$\pm 0.025$		% FSR	
Gain Drift		$\pm 10$ ppm		$\pm 3$ ppm		ppm/°C	
Conversion Time <sup>4</sup> 521X series 520X series			13 50		13 50	$\mu$ sec $\mu$ sec	
REFERENCE INPUT/OUTPUT <sup>10</sup>		MINIMUM		TYPICAL		MAXIMUM	UNITS
Internal Reference: Voltage .....				-6.3			V
Accuracy .....				$\pm 1$			%
Tempco of Drift .....				$\pm 5$ ppm			/°C
Max. External Current .....						4	mA
External Reference: Voltage .....				-10.000			V
Loading .....						-5	mA
POWER SUPPLIES		MINIMUM		TYPICAL		MAXIMUM	UNITS
Power Supply Range $\pm 15$ V supplies .....		$\pm 11.4$		$\pm 15$		$\pm 16.5$	Volts
POWER SUPPLIES		TYP.	MAX.	TYP.	MAX.	UNITS	
Power Supply Rejection <sup>5</sup> : +15V supply .....		$\pm 0.005$	$\pm 0.02$	$\pm 0.005$	$\pm 0.02$	% FSR/% V <sub>S</sub>	
-15V supply .....		$\pm 0.01$	$\pm 0.05$	$\pm 0.005$	$\pm 0.02$	% FSR/% V <sub>S</sub>	
Current Drain: +15V supply .....		13	18	13	18	mA	
-15V supply .....		-15	-19	-15	-19	mA	
+5V supply .....		10	15	10	15	mA	
Power Consumption .....		470	590	470	590	mW	
DIGITAL INPUTS (All Models)		MINIMUM		TYPICAL		MAXIMUM	UNITS
Logic Levels: Logic "1" .....		2.0					V
Logic "0" .....						0.7	V
Clock Input: <sup>6</sup> Pulse Width High .....		45					nsec
Pulse Width Low .....		45					nsec
Loading High (V <sub>IN</sub> =2.4V)				2		20	$\mu$ A
Loading Low (V <sub>IN</sub> =0.3V)				-0.25		-0.4	mA
Frequency							
520X series .....						260	KHz
521X series .....						1	MHz
Start Convert Input: Loading High (V <sub>IN</sub> =2.4V)				4		40	$\mu$ A
Loading Low (V <sub>IN</sub> =0.3V)				-0.25		-0.4	mA
Set-up Time Start Low to Clock <sup>7</sup>		10					nsec
DIGITAL OUTPUTS (All Models)		MINIMUM		TYPICAL		MAXIMUM	UNITS
Logic Coding <sup>8</sup> : Unipolar ranges .....				Complementary Straight Binary			
Bipolar ranges .....				Complementary Offset Binary			
Logic Levels: Logic "1" .....		+2.4		+3.6			V
Logic "0" .....				+0.15		+0.3	V
Output Drive Capability, All Outputs <sup>9</sup> :							
Logic "1" .....		8 TTL Loads					
Logic "0" .....		2 TTL Loads					

Devices are available screened to MIL-STD-883 Method 5008 Class B.

## NOTES:

1. Intech tests and guarantees maximum linearity error at ambient temperature and at both the high and low extremes of the specified operating temperature range.
2. 1 LSB for a 12 bit converter corresponds to 0.024%FSR. See Note 3.
3. FSR stands for Full Scale Range and is equal to the peak to peak voltage of the selected input range. For the  $\pm 10\text{V}$  input range, FSR is 20 volts, and 1 LSB is equal to 4.88 mV. For the  $\pm 5\text{V}$  ranges, FSR is 10 volts, and 1 LSB is equal to 2.44 mV.
4. Conversion time is defined as the width of the converter's STATUS (E.O.C.) pulse (see Timing Diagram). Intech guarantees ADC521X Series converters will meet all specs with clock frequencies up to 1 MHz. A 1 MHz clock gives a STATUS pulse that is 12  $\mu\text{Sec}$  wide. The 13  $\mu\text{Sec}$  spec reflects the fact that unless careful timing precautions are taken, it will usually take 13 clock periods to update digital output data. A 260 KHz clock used with the ADC520X series gives a 50  $\mu\text{s}$  status pulse.
5. Intech tests and guarantees Power Supply Rejection over the  $\pm 15\text{V} \pm 3\%$  range.
6. The clock may be asymmetrical with minimum positive or negative pulse width. See Note 4.
7. In order to reset the converter, START CONVERT must be brought low at least 10 nSec prior to a low to high clock transition. See Timing Diagram.
8. CSB = Complementary Straight Binary  
COB = Complementary Offset Binary  
Serial and parallel output data have the same coding. Serial data is Non-Return to Zero (NRZ) format. See Output Coding and Timing Diagram.
9. One TTL load is defined as sinking 40  $\mu\text{A}$  with a logic "1" applied and sourcing 1.6 mA with a logic "0" applied.
10. ADC52X0, ADC52X1, ADC52X2, and ADC52X6 have an internal -6.3V reference. ADC52X3, ADC52X4, and ADC52X5 and ADC52X7 require an external -10.000V reference.

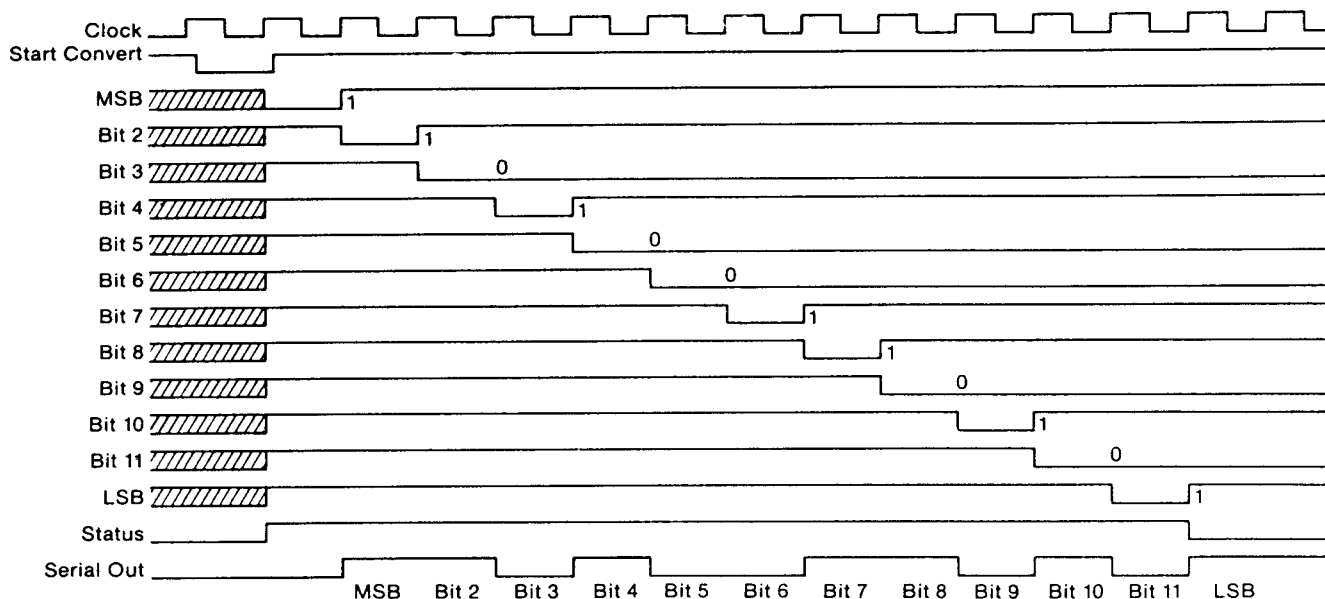
## DATA OUTPUT

The ADC5200 Series provides the user with both serial and parallel outputs. Serial and parallel output data have the same coding. Serial data is in Non-return to Zero format.

## DIGITAL OUTPUT CODING

ADC52X1/52X4 $\pm 5\text{V}$	ADC52X2/52X5 $\pm 10\text{V}$	ADC52X0/ADC52X3 0 to -10V	ADC52X6/52X7 0 to +10V	DIGITAL OUTPUT
+4.9976V +4.9951V	+ 9.9951V + 9.9902V	- 0.0024V - 0.0048V	+ 9.9976V + 9.9951V	0000 0000 0000 0000 0000 0001
+0.0024V 0.0000V -0.0024V	+ 0.0049V 0.0000V - 0.0049V	- 4.9976V - 5.0000V - 5.0024V	+ 5.0024V + 5.0000V + 4.9976V	0111 1111 1110 0111 1111 1111 1000 0000 0000
-4.9976V -5.0000V	- 9.9951V -10.0000V	- 9.9976V -10.0000V	+ 0.0024V 0.0000V	1111 1111 1110 1111 1111 1111

## TIMING DIAGRAM



## SAMPLE AND HOLD

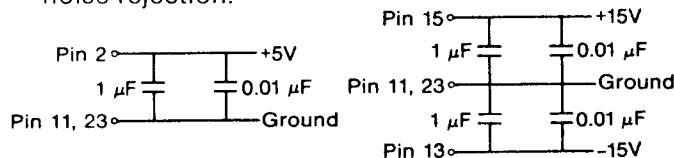
For those applications that require a sample and hold, the SH346/347 is an ideal device. It is a high speed, adjustment free sample/hold amplifier that features 1.0  $\mu\text{sec}$  acquisition time, 0.01% accuracy and a low glitch and droop rate.

## HANDLING OF GROUNDS

Layout and decoupling techniques: Ground pins 11 and 23 are not internally connected and should be connected externally as directly or close to the package as possible. They must be connected to the system analog ground, preferably through a large ground plane under the package.

To run the grounds separately, connect a 1  $\mu\text{F}$  bypass capacitor between pins 11 and 23.

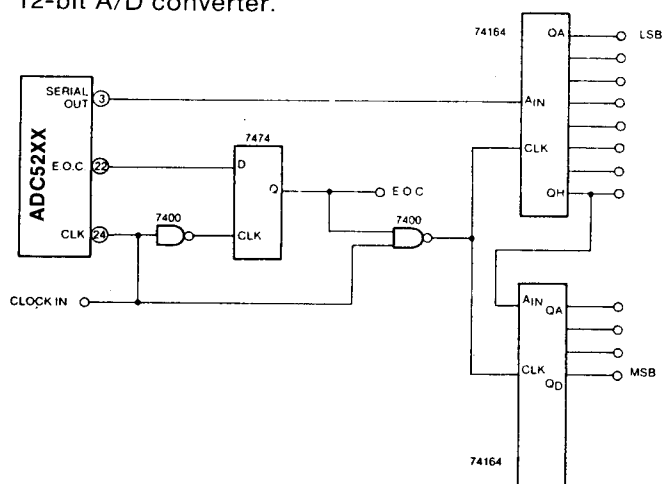
Power supplies should be decoupled by using tantalum and electrolytic capacitors as close to the pins as possible for peak performance and noise rejection.



POWER SUPPLY DECOUPLING

## SERIAL TO PARALLEL CONVERSION

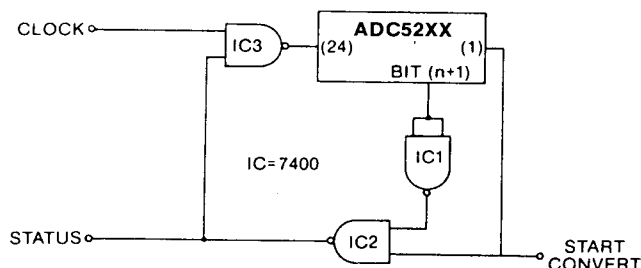
Data may be sent in serial format and converted to parallel as shown. This process can reduce the number of transmission lines from 14 to 3 for a 12-bit A/D converter.



## SHORT CYCLE OPERATION

The ADC5200 series can be short cycled to less than 12 bits resolution, which gives a faster conversion time.

When a conversion is in process, bit (n+1) will go low as bit n is being set. The Start Convert signal is high at this point and Status (IC2 output) will go low gating off the clock at IC3, thus ending the conversion.



## PIN DESIGNATIONS

Pin 1	Start Convert	Pin 24	Clock Input
Pin 2	+5V Supply	Pin 23	Ground
Pin 3	Serial Output	Pin 22	Status (E.O.C.)
Pin 4	Bit 6	Pin 21	Bit 7
Pin 5	Bit 5	Pin 20	Bit 8
Pin 6	Bit 4	Pin 19	Bit 9
Pin 7	Bit 3	Pin 18	Bit 10
Pin 8	Bit 2	Pin 17	Bit 11
Pin 9	Bit 1 (MSB)	Pin 16	Bit 12 (LSB)
Pin 10	N.C.	Pin 15	+15V Supply
Pin 11	Ground	Pin 14	Analog Input
Pin 12	Ref. In/Out (-6.3V)	Pin 13	-15V Supply

Note: Pin 10 has no internal connection

## PART NUMBER

ADC52XX H/B

Model

Conversion Time

0 - 50  $\mu$ sec. max.

1 - 13  $\mu$ sec. max

Analog Inputs

0 - 0 to -10V(5K $\Omega$ )int.ref.

1 - -5V to +5V(5K $\Omega$ )int.ref.

2 - -10V to +10V(10K $\Omega$ )int.ref.

3 - 0 to -10V(5K $\Omega$ )ext.ref.

4 - -5V to +5V(5K $\Omega$ )ext.ref.

5 - -10V to +10V(10K $\Omega$ )ext.ref.

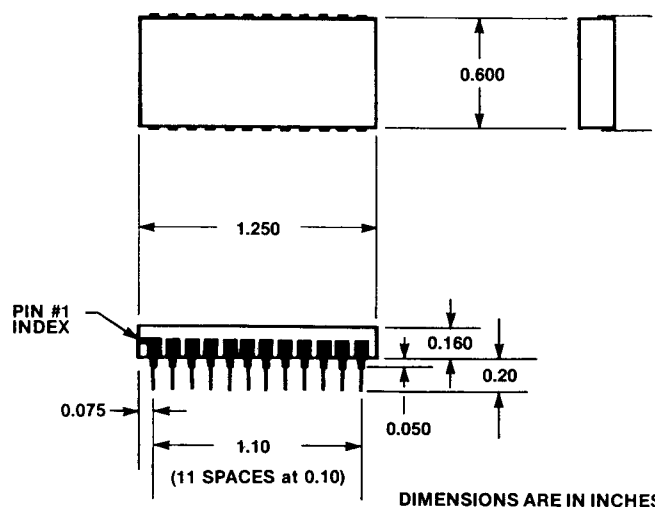
6 - 0 to +10V(5K $\Omega$ )int.ref.

7 - 0 to +10V(5K $\Omega$ )ext.ref.

MIL-STD-883 screening.  
Omit for comm'l or industrial

Operation  
-55°C to +125°C. Omit for standard 0°C to +70°C

## MECHANICAL OUTLINE



DIMENSIONS ARE IN INCHES

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# ADVANCED ANALOG

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The information in this data sheet has been carefully checked and is believed to be accurate. However, no responsibility is assumed for possible errors. The specifications are subject to change without notice.

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