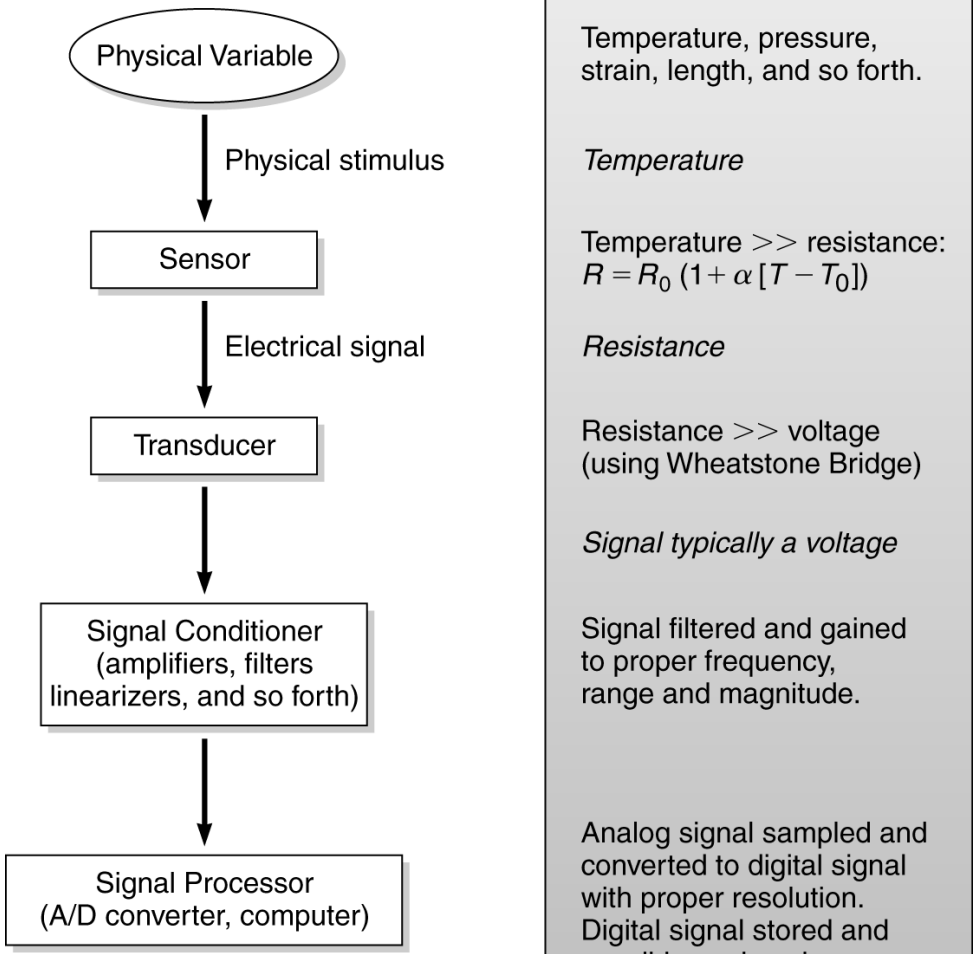
Analog-to-Digital Conversion



Analog-to-Digital (A/D) Converters

BURR-BROWN®

ADS7825*B*

www.burr-brown.com/databook/ADS7825.html

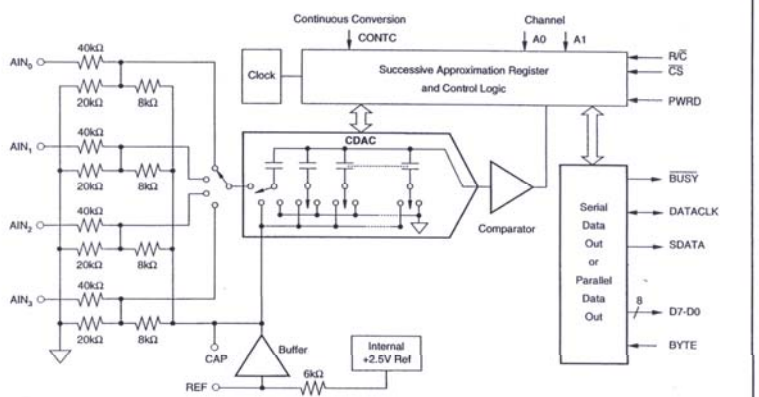
4 Channel, 16-Bit Sampling CMOS A/D Converter

FEATURES

- 25µs max SAMPLING AND CONVERSION
- SINGLE +5V SUPPLY OPERATION
- PIN-COMPATIBLE WITH 12-BIT ADS7824
- PARALLEL AND SERIAL DATA OUTPUT
- 28-PIN 0.3" PLASTIC DIP AND SOIC
- ±2.0 LSB max INL
- 50mW max POWER DISSIPATION
- 50µW POWER DOWN MODE
- ±10V INPUT RANGE, FOUR CHANNEL MULTIPLEXER
- CONTINUOUS CONVERSION MODE

DESCRIPTION

The ADS7825 can acquire and convert 16 bits to within ±2.0 LSB in 25µs max while consuming only 50mW max. Laser-trimmed scaling resistors provide the standard industrial ±10V input range and channel-to-channel matching of ±0.1%. The ADS7825 is a low-power 16-bit sampling A/D with a four channel input multiplexer, S/H, clock, reference, and a parallel/serial microprocessor interface. It can be configured in a continuous conversion mode to sequentially digitize all four channels. The 28-pin ADS7825 is available in a plastic 0.3" DIP and in a SOIC, both fully specified for operation over the industrial –40°C to +85°C range.



International Airport Industrial Park • Mailing Address: PO Box 11400, Tucson, AZ 85734 • Street Address: 6730 S. Tucson Blvd., Tucson, AZ 85706 • Tel: (520) 746-1111 • Twx: 910-952-1111
Internet: http://www.burr-brown.com/ • FAXLine: (800) 548-6133 (US/Canada Only) • Cable: BBRCORP • Telex: 066-6491 • FAX: (520) 889-1510 • Immediate Product Info: (800) 548-6132

PDS-1304B

Printed in U.S.A. October, 1997

The signal is converted into binary using various methods, such as successive-approximation and ramp-conversion.

A/D Conversion Process

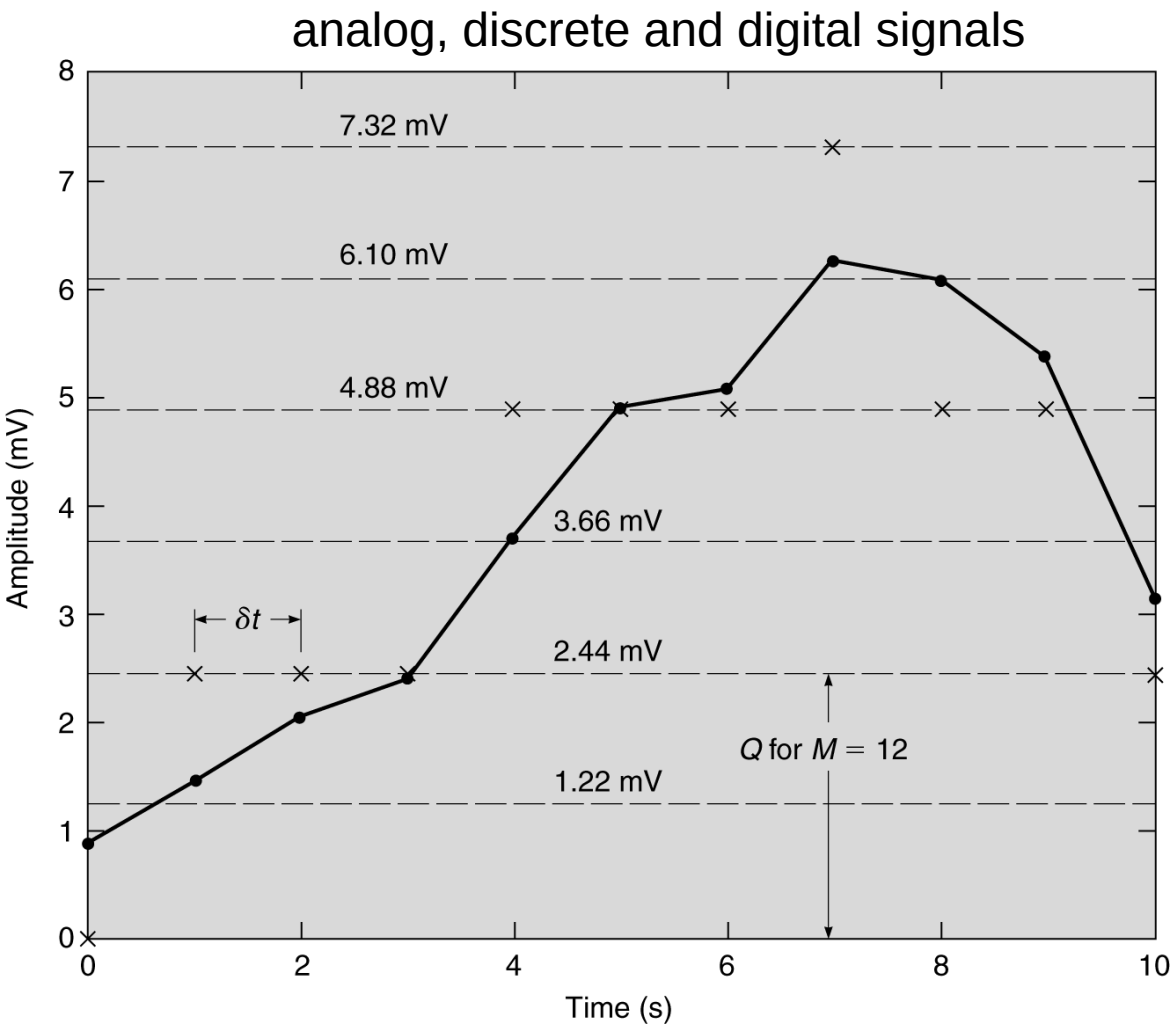


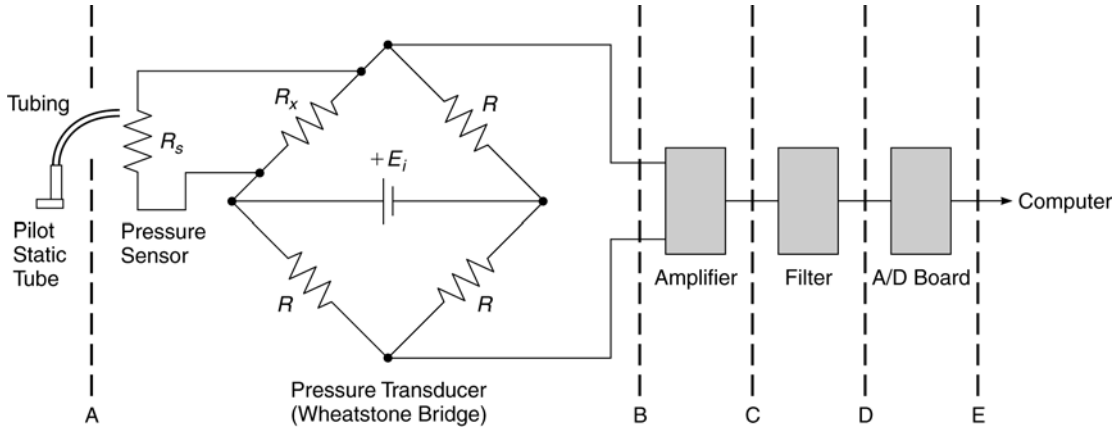
Figure 6.15

M-bit Terminology

Term	Formula	M=8	M=12
MSB Value	2^{M-1}	128	2048
LSB Value	2^{0}	1	1
Maximum Possible Value	$2^{M}-1$	255	4095
Minimum Possible Value	0	0	0
Number of Possible Values	2^{M}	256	4096
MSB Weight	2^{-1}	1/2	1/2
LSB Weight	2^{-M}	1/256	1/4096
Resolution, Q (mV/bit) for $E_{FSR} = 10$ V	$E_{FSR}/2^{M}$	39.10	2.44
Dynamic Range (dB)	$20 \cdot log_{10}(Q/Q_o)$	-28	-52
Absolute Quantization Error (mV)	$\pm Q/2$	$\pm$19.60	$\pm$1.22

Table 6.4: M-bit terminology.

In-Class Example



A: What is the flow velocity if $\Delta p = 58$ Pa ?

A-B: Wheatstone bridge (pp. 72-75) where

$$E_o = E_i \left[R_1/(R_1+R_2) - R_3/(R_3+R_4) \right] \text{ (Eqn.4.26)}$$

In-Class Example

A-B: What is R_x needed to give E_o =0 V at U = 0 m/s ?

A-B: At the highest U, R_1 increases by 20 % because of an increase in R_s. What is E_o at the highest U?

B-C: What is the amplifier gain to achieve 80 % of the full-scale range of the A/D board at the highest U ?

B-C: If a non-inverting op amp is used (see p. 147), what should be the values of its resistances ?

In-Class Example

C-D: What type of filter would be appropriate to use ?

D-E: What bit A/D board is required to have less than 0.2 % error in the voltage reading of the highest-U condition ?