

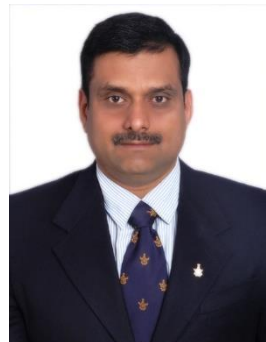


Microprocessors and Interfaces: 2021-22

Lecture 32

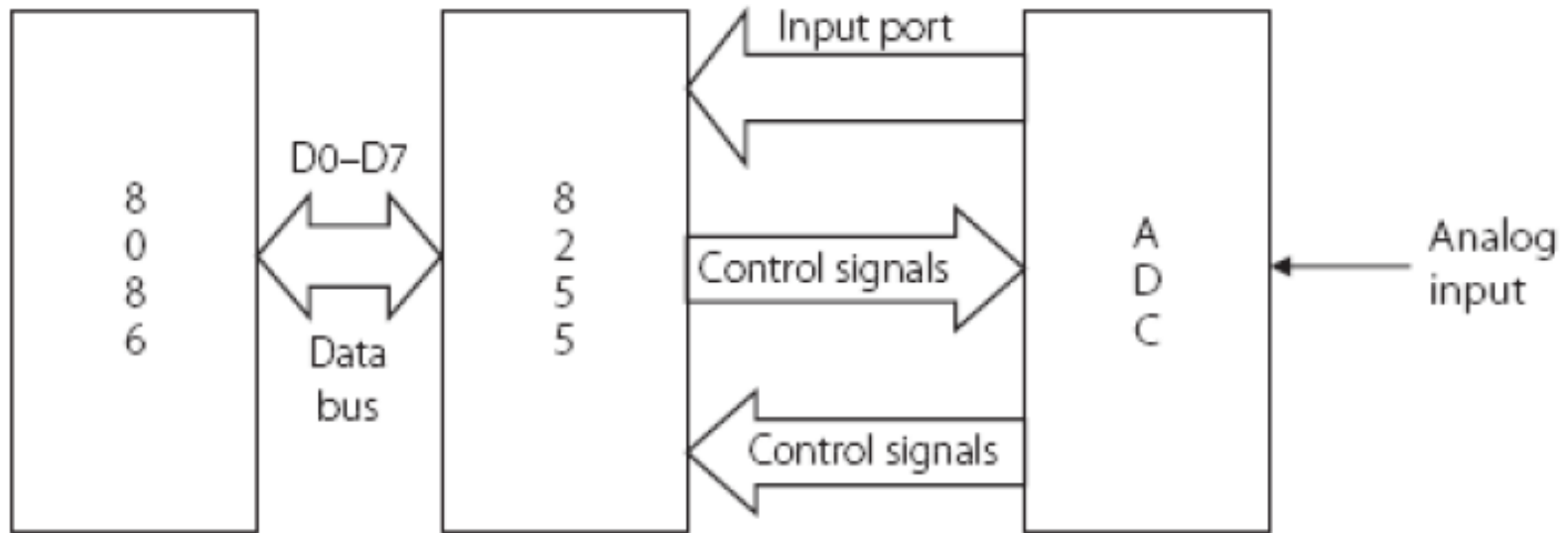
ANALOG-TO-DIGITAL (ADC) & DIGITAL-TO-ANALOG (DAC) CONVERTERS

By Dr. Sanjay Vidhyadharan



ADC (Analog-to Digital Converter)

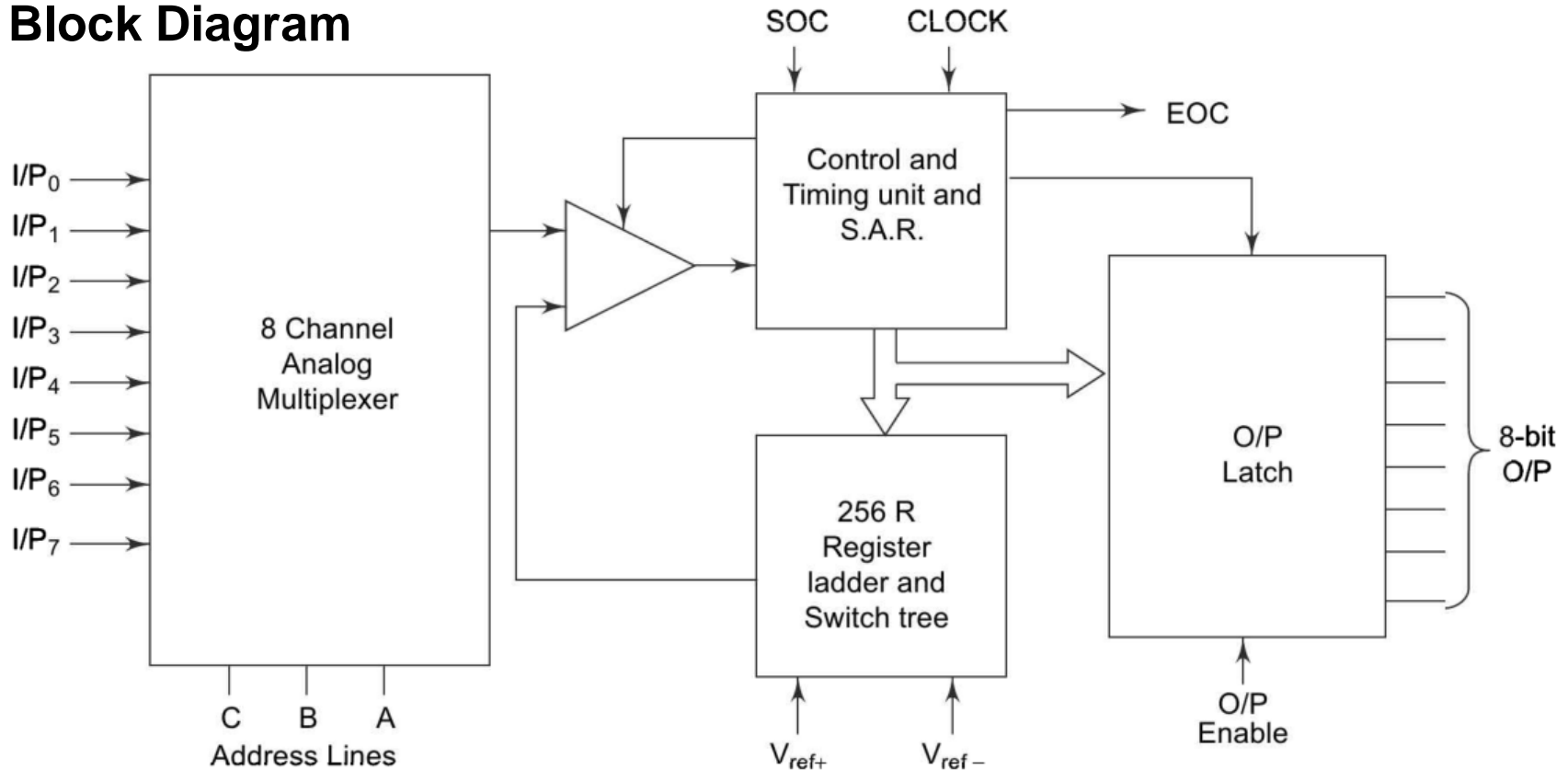
Interface with 8086



SOC: Start of Conversion
EOC : End of Conversion

ADC 0808 / 0809

Block Diagram



Low-cost ADC, Power 15 mW,

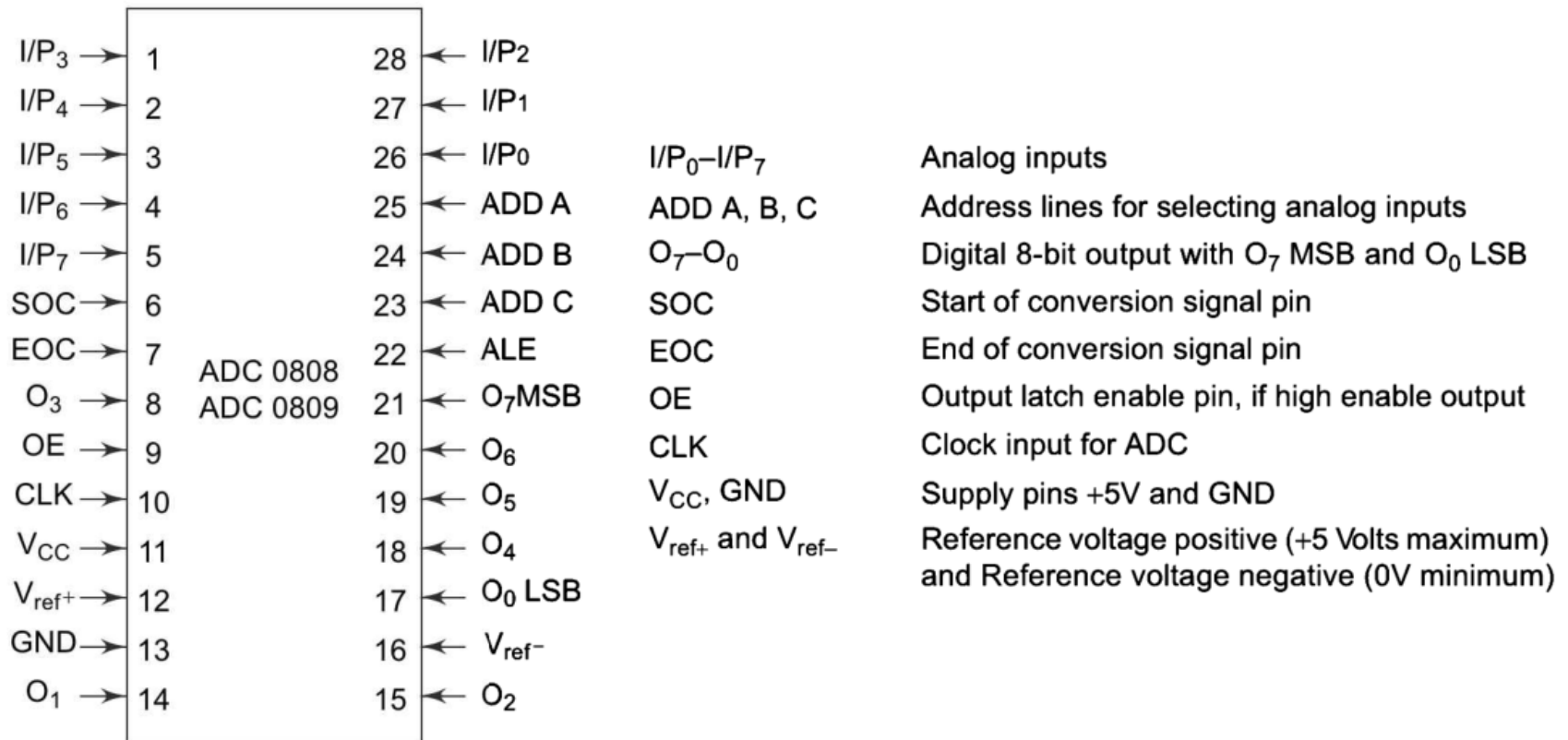
Compatible with a wide range of microprocessors. Power Supply 5 V

Moderate speed 100 μ s

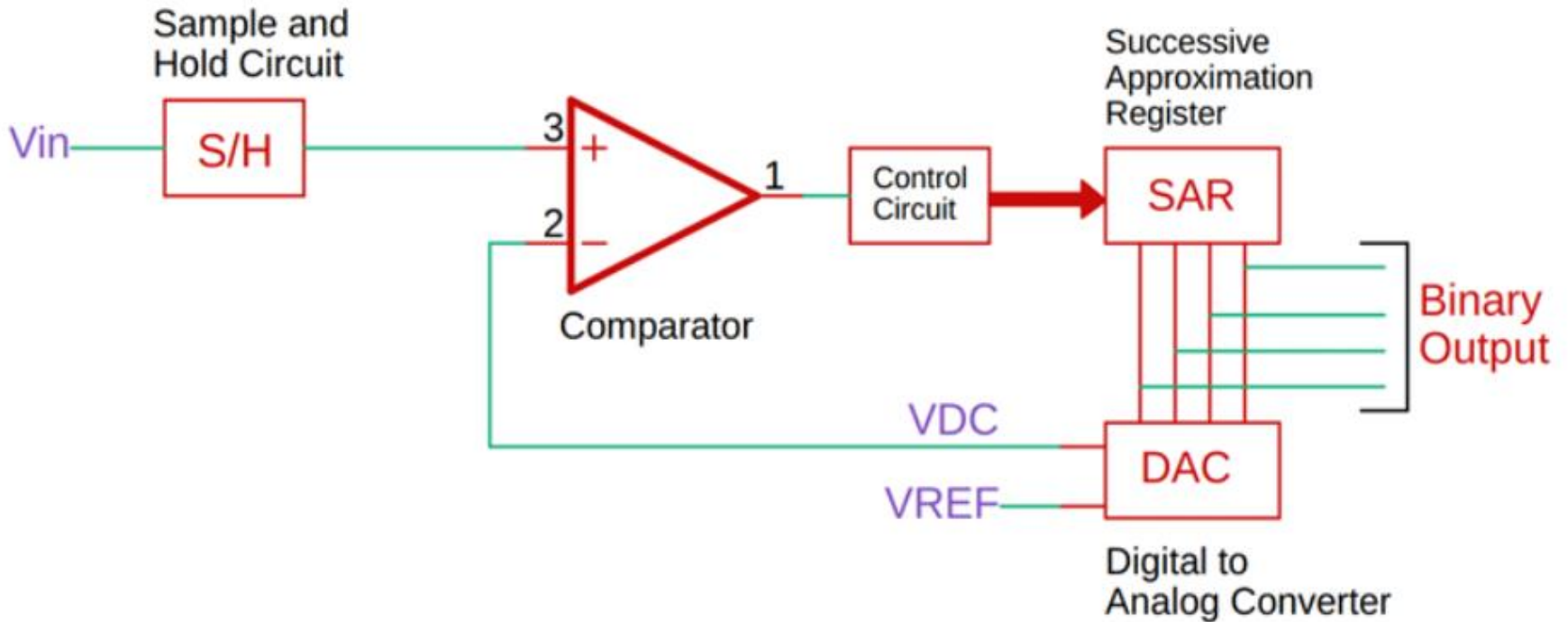
Moderate accuracy Error \pm LSB

ADC 0808 / 0809

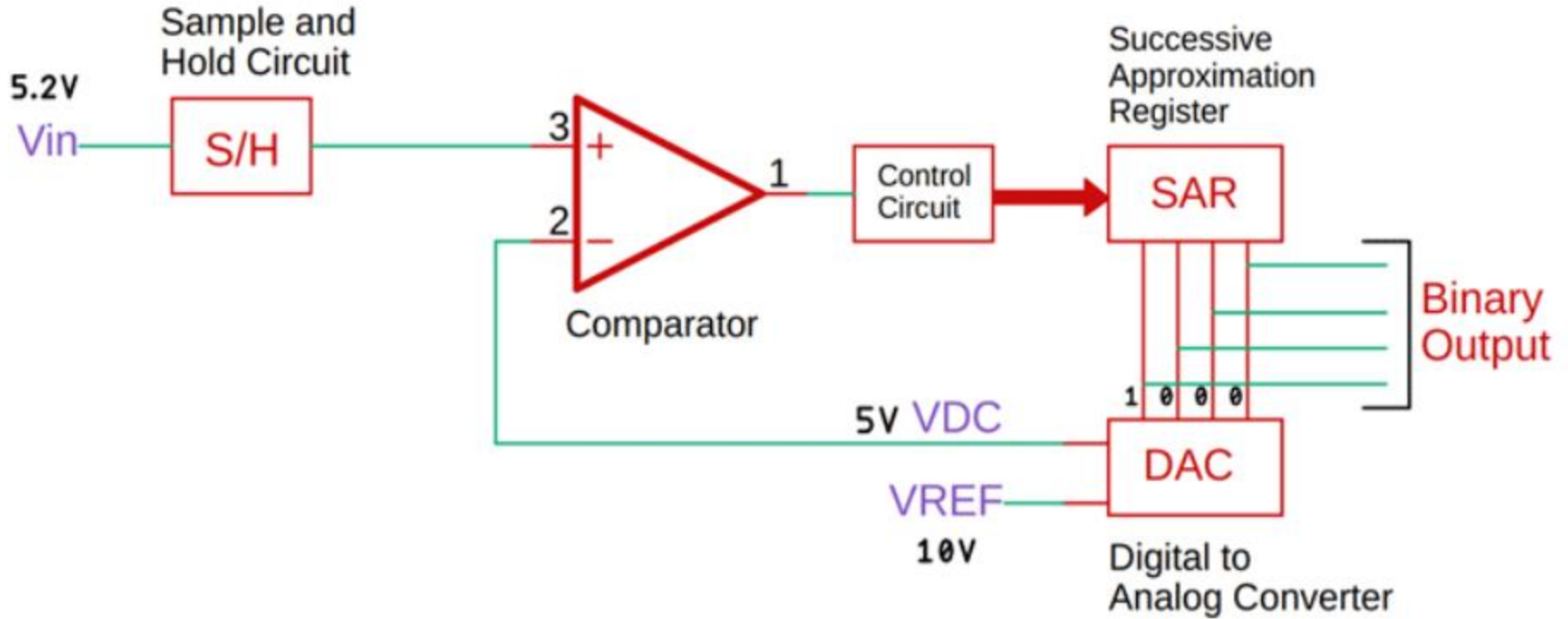
Pin Diagram



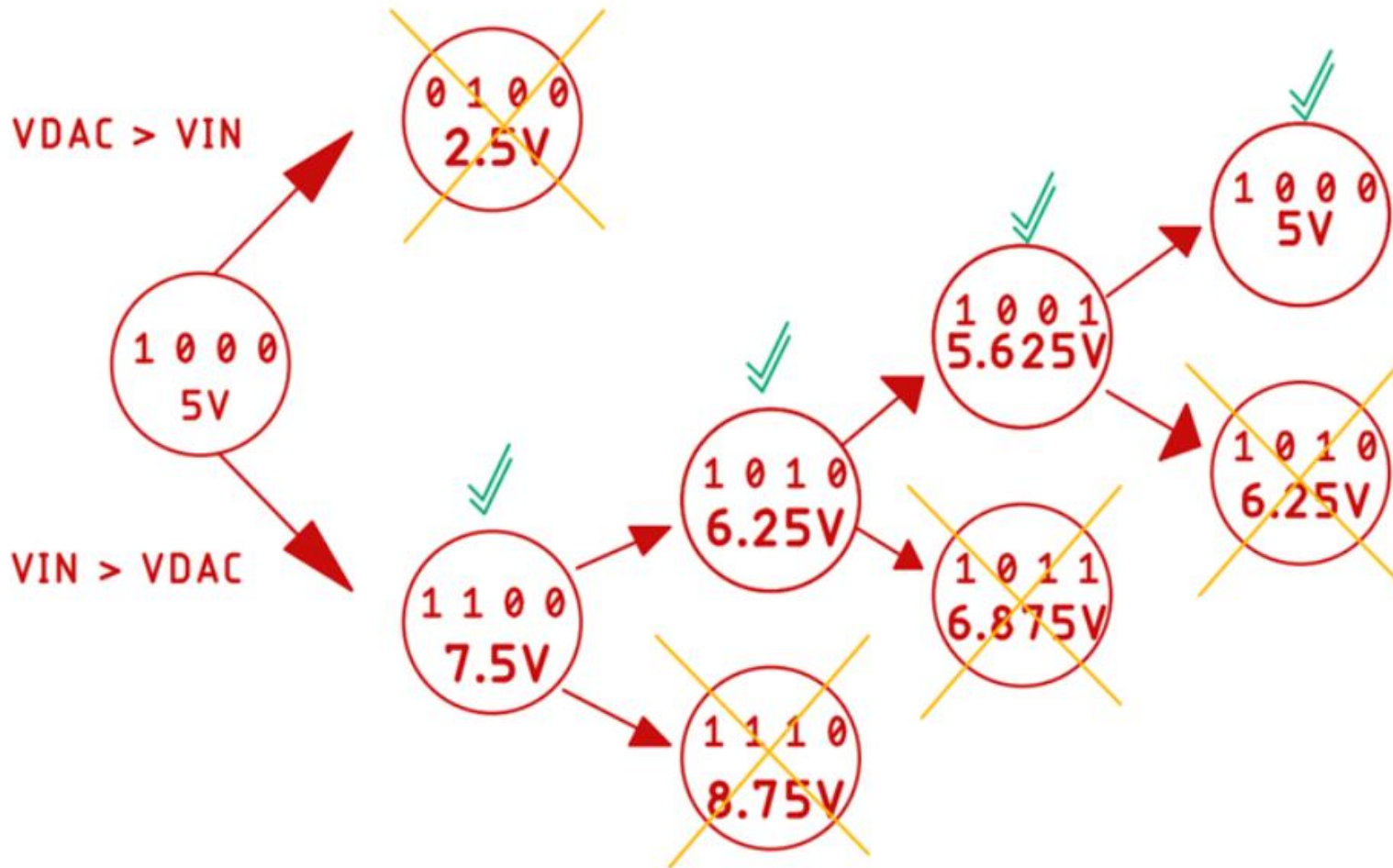
Successive Approximation ADC



Successive Approximation ADC

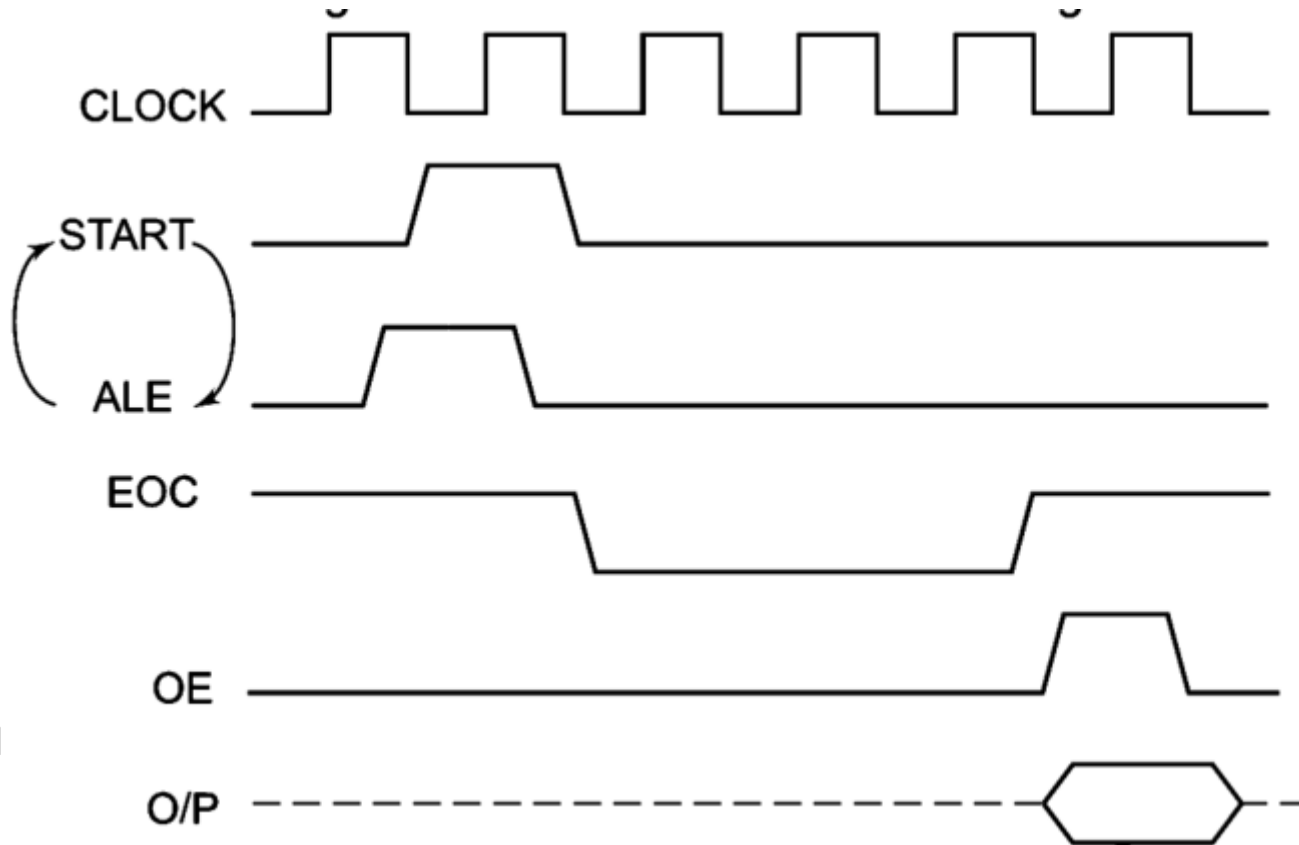


Successive Approximation ADC



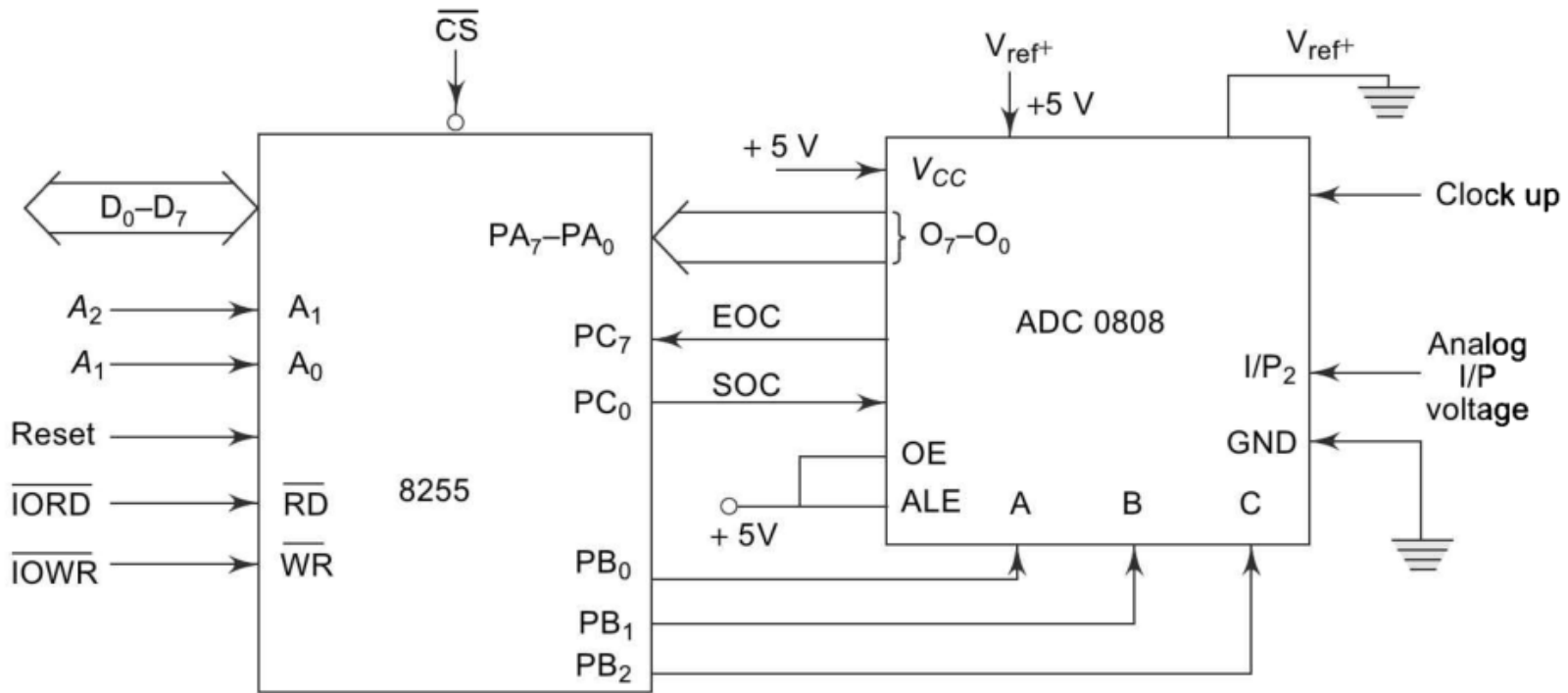
ADC 0808 / 0809

Timing Diagram



ADC 0808 / 0809

Interface ADC 0808 with 8086 using 8255 ports. Use Port A of 8255 for transferring digital data output of ADC to the CPU and Port C for control signals. Assume that an analog input is present at I/P₂ of the ADC and a clock input of suitable frequency is available for ADC. Draw the schematic and write required ALP.



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D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀	Control word
1	0	0	1	1	0	0	0	= 98 H

D7=1; I/O Mode.

D6=0 and D5=0; Port A Mode

D4=1; Port A is input port

D3=1; Port C (Upper) is input

D2=0; Port B Mode 0.

D1=0; Port B is output

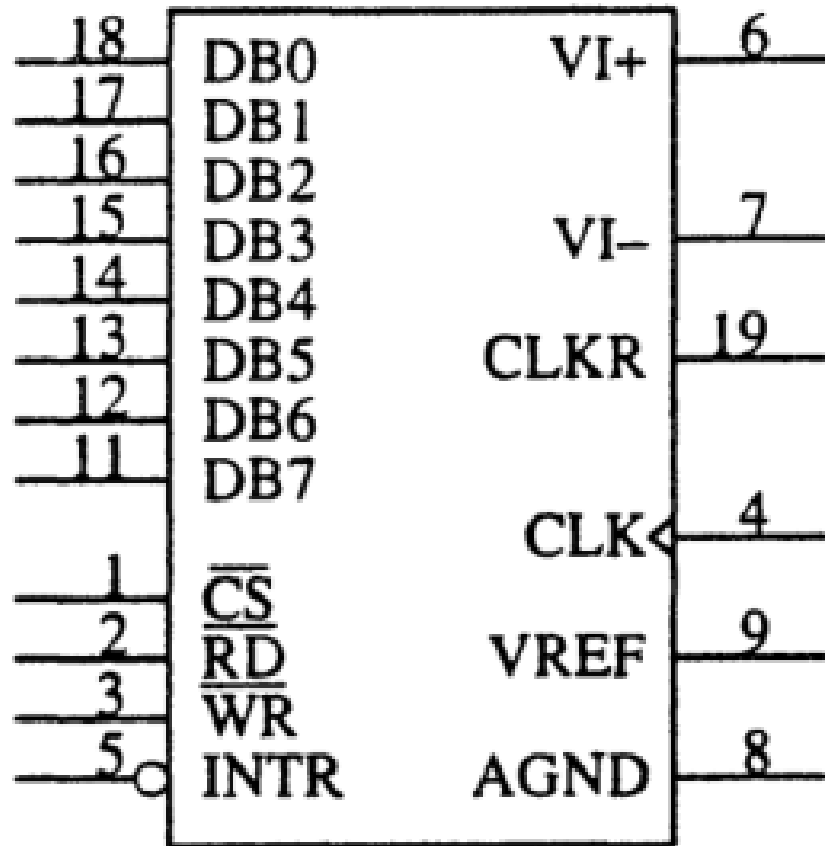
D0=0; Port C (Lower) is output

The required ALP is given as follows:

```

MOV AL,98 H           ; Initialise 8255 as
OUT CWR,AL           ; discussed above
MOV AL,02H           ; Select I/P2 as analog
OUT PORT B,AL        ; input
MOV AL,00H           ; Give start of conversion
OUT PORT C,AL        ; pulse to the ADC.
MOV AL,01 H         ;
OUT PORT C,AL        ;
MOV AL,00H           ;
OUT PORT C,AL        ;
WAIT : IN AL,PORTC   ; Check for EOC by
RCL                  ; reading port C upper and
JNC WAIT             ; rotating through carry.
IN AL,PORTA          ; If EOC, read digital equivalent in
                    AL
HLT                  ; Stop
    
```

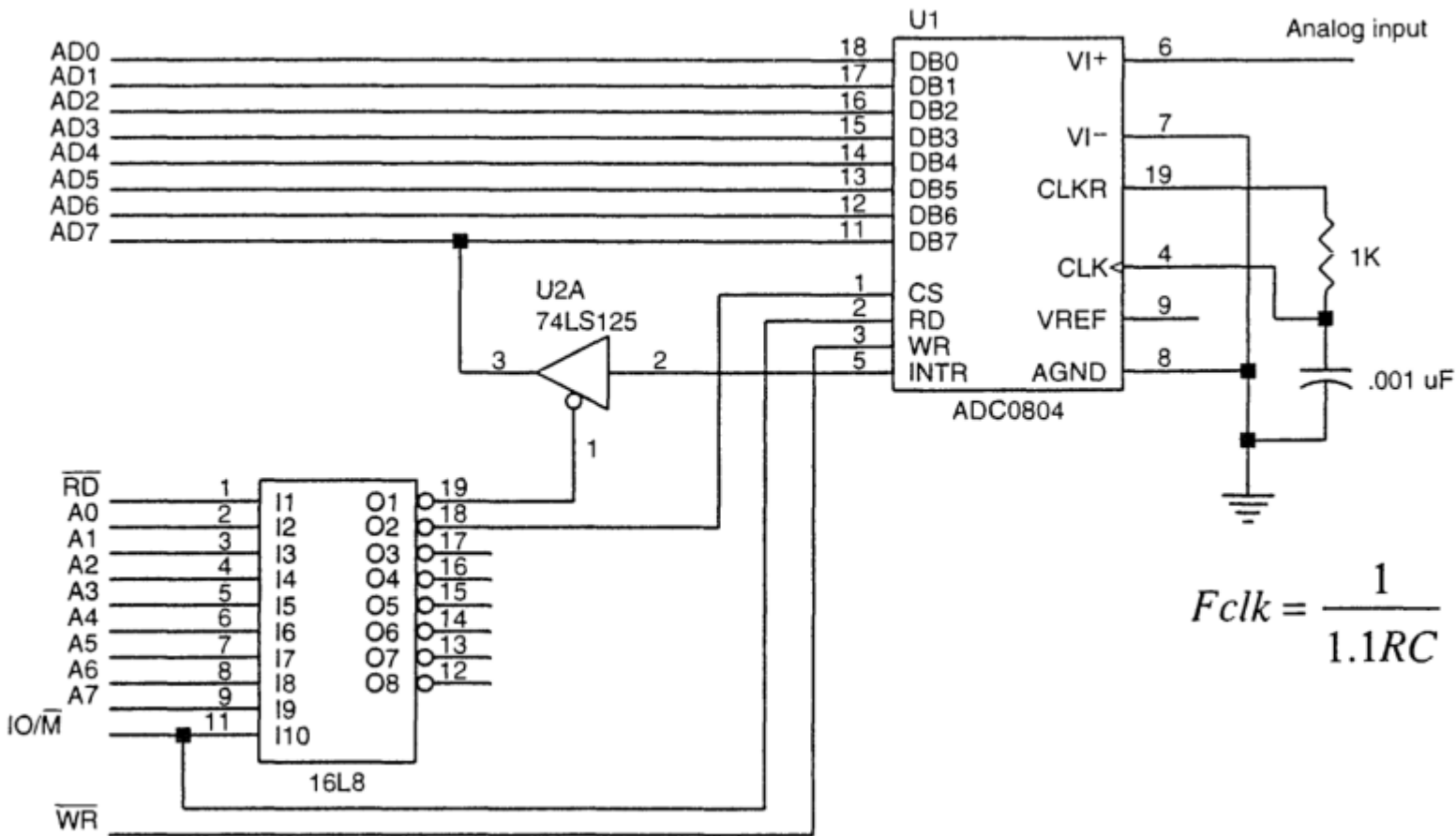
ADC 0804



ADC0804

SOC: Start of Conversion \overline{WR} ' and \overline{CS} '
EOC : End of Conversion INTR

ADC 0804

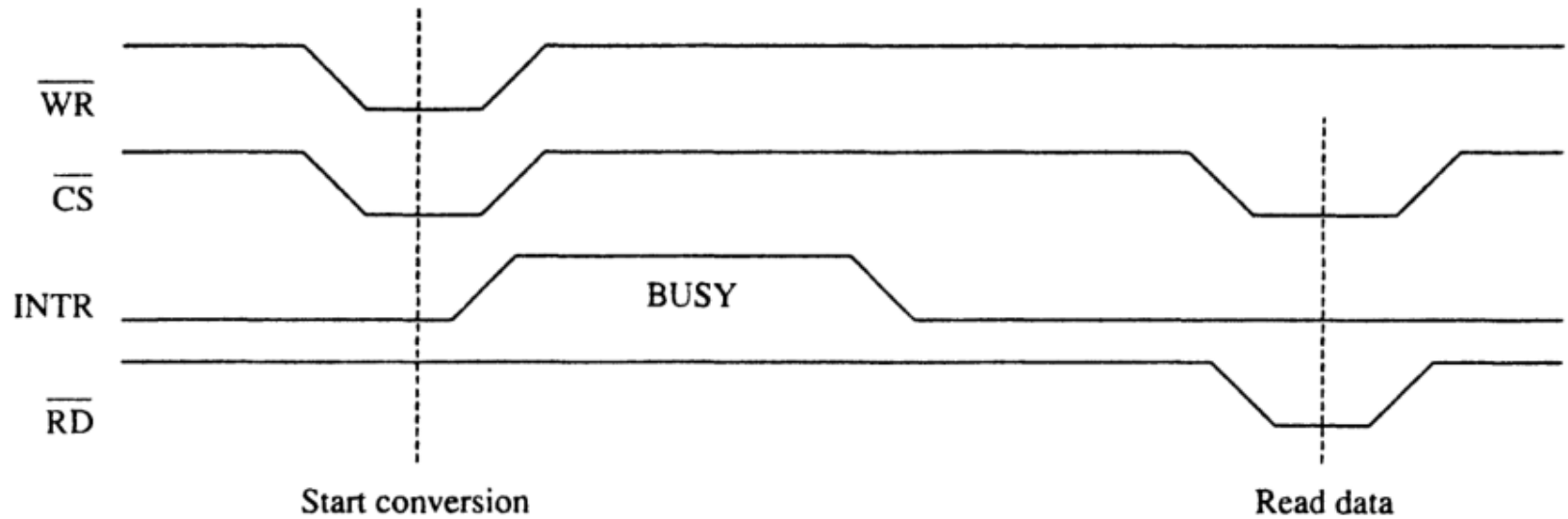


$$F_{clk} = \frac{1}{1.1RC}$$

Permissible range of clock frequencies is 100 KHz - 1460 KHz.
desirable to use a frequency as close as possible to 1460 KHz so
conversion time is minimized

ADC 0804

Timing Diagram



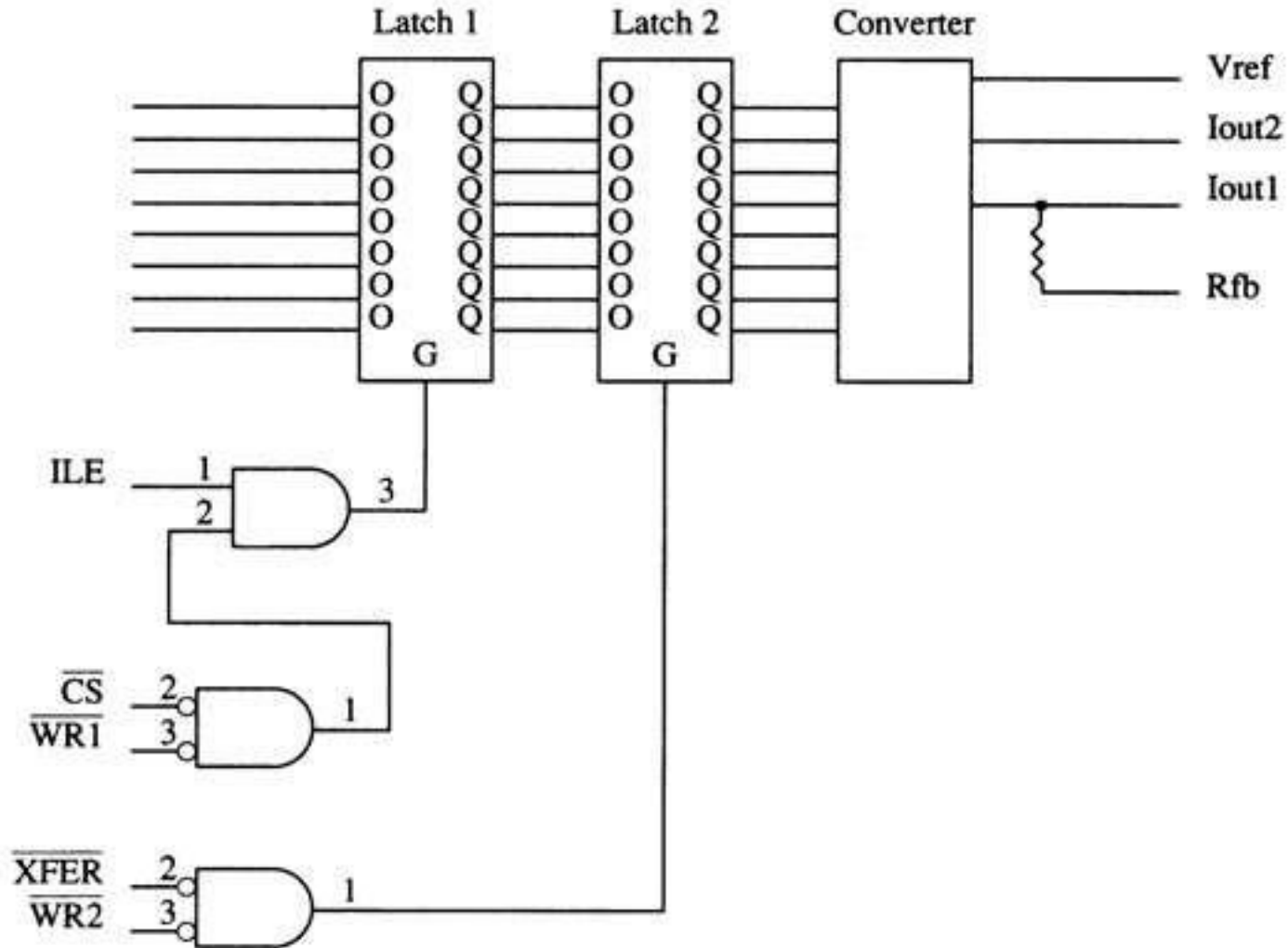
DAC0830

- A fairly common and low-cost digital-to-analog converter is the DAC0830.
- An 8-bit converter that transforms an 8-bit binary number into an analog voltage.
- Other converters are available that convert from 10-, 12-, or 16-bit binary numbers into analog voltages.

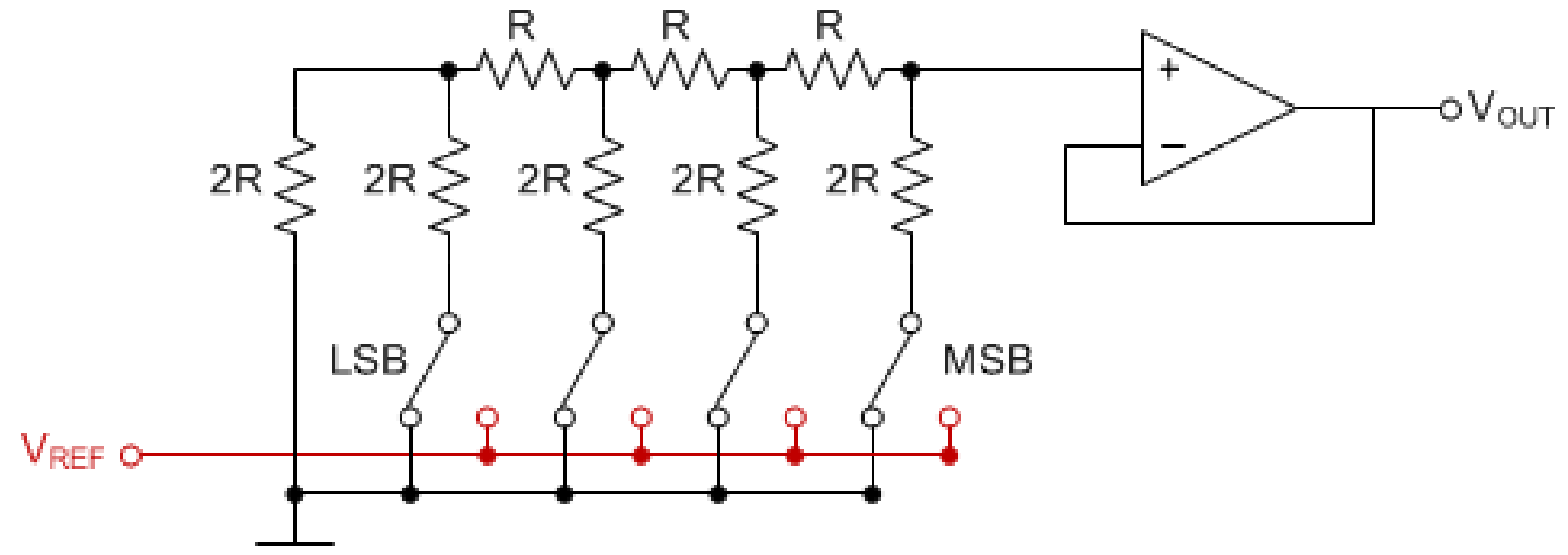
DAC0830

- The number of voltage steps generated by the converter is equal to the number of binary input combinations.
 - an 8-bit converter generates 256 voltage levels
 - a 10-bit converter generates 1024 levels
- The DAC0830 is a medium-speed converter that transforms a digital input to an analog output in approximately $1.0 \mu\text{s}$.

DAC0830

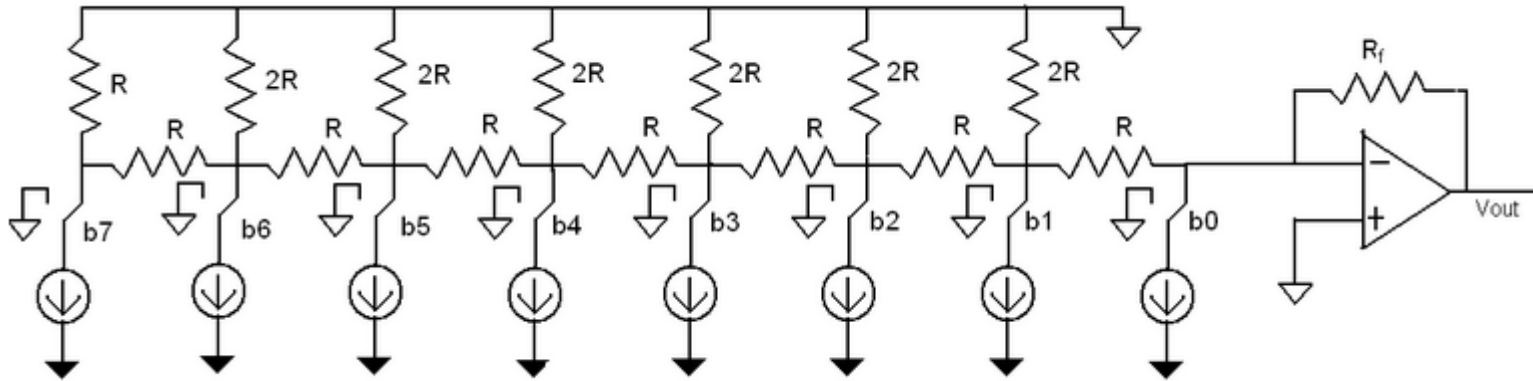


R-2R Ladder DAC



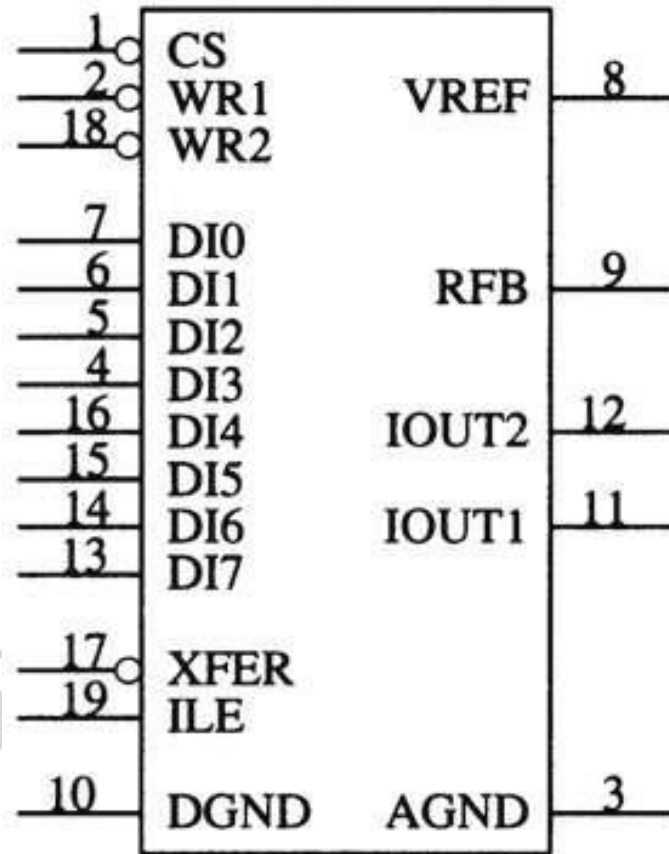
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R-2R Ladder DAC



Sanjay v

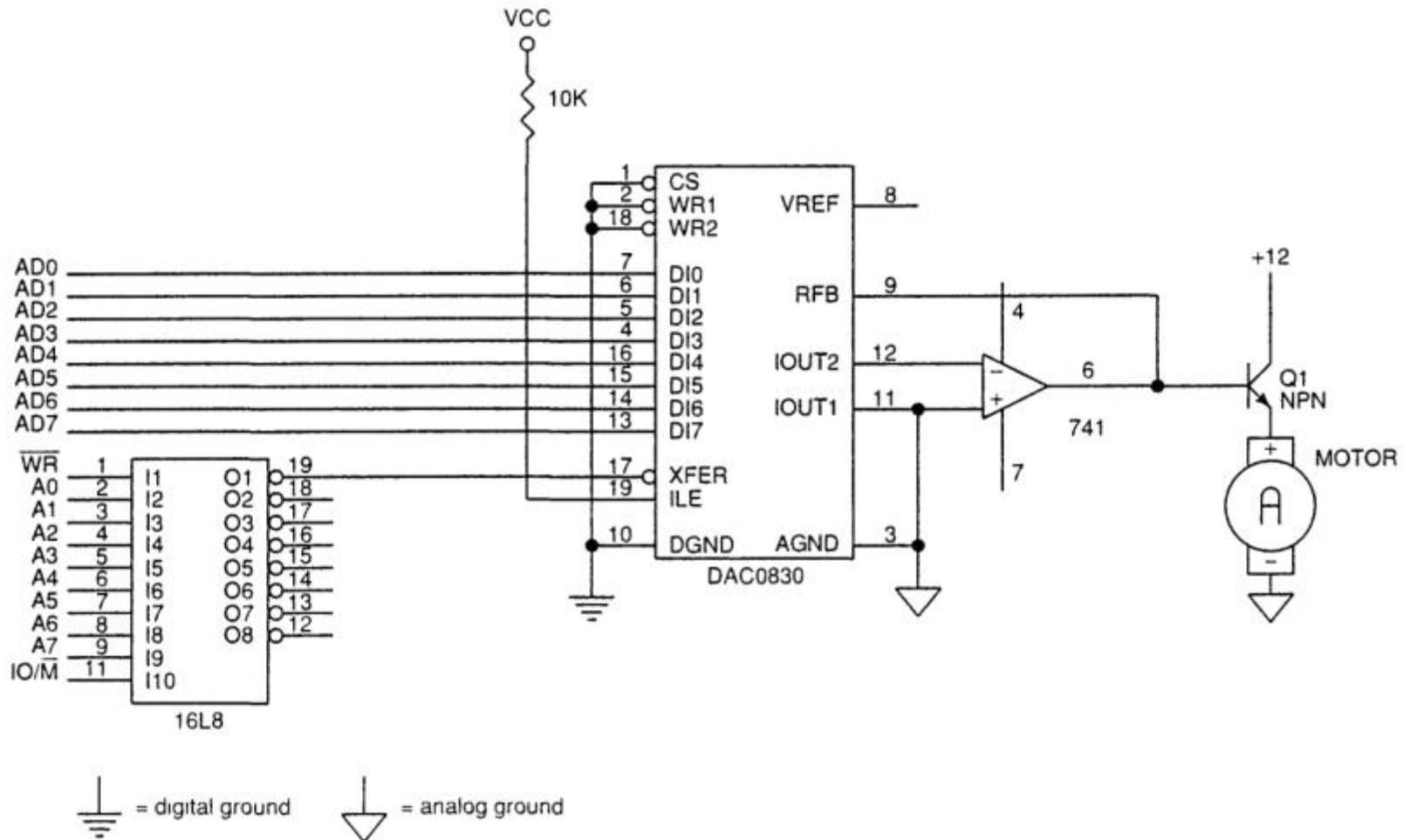
DAC0830



DAC0830

Because this is an 8-bit converter, its output step voltage is defined as $-V_{REF}$ (reference voltage), divided by 255. The step voltage is often called the resolution of the converter

DAC0830



Analog outputs labeled IOUT1 & IOUT2 are inputs to an external operational amplifier.



Thankyou

Sanjay Vichyadhharan