

4.5 ADC and DAC Interfacing:

The Analog to Digital Conversion is a quantizing process. Here the analog signal is represented by equivalent binary states. The A/D converters can be classified into two groups based on their conversion techniques.

In the first technique it compares given analog signal with the initially generated equivalent signal. In this technique, it includes successive approximation, counter and flash type converters. In another technique it determines the changing of analog signals into time or frequency. This process includes integrator-converters and voltage-to-frequency converters. The first process is faster but less accurate, the second one is more accurate. As the first process uses flash type, so it is expensive and difficult to design for high accuracy.

ADC 0808/0809 Chip

The ADC 0808/0809 is an 8-bit analog to digital converter. It has 8 channel multiplexer to interface with the microprocessor.

This chip is popular and widely used ADC. ADC 0808/0809 is a monolithic CMOS device. This device uses successive approximation technique to convert analog signal to digital form. One of the main advantage of this chip is that it does not require any external zero and full scale adjustment, only +5V DC supply is sufficient.

Let us see some good features of ADC 0808/0809:

- The conversion speed is much higher
- The accuracy is also high
- It has minimal temperature dependence
- Excellent long term accuracy and repeatability
- Less power consumption

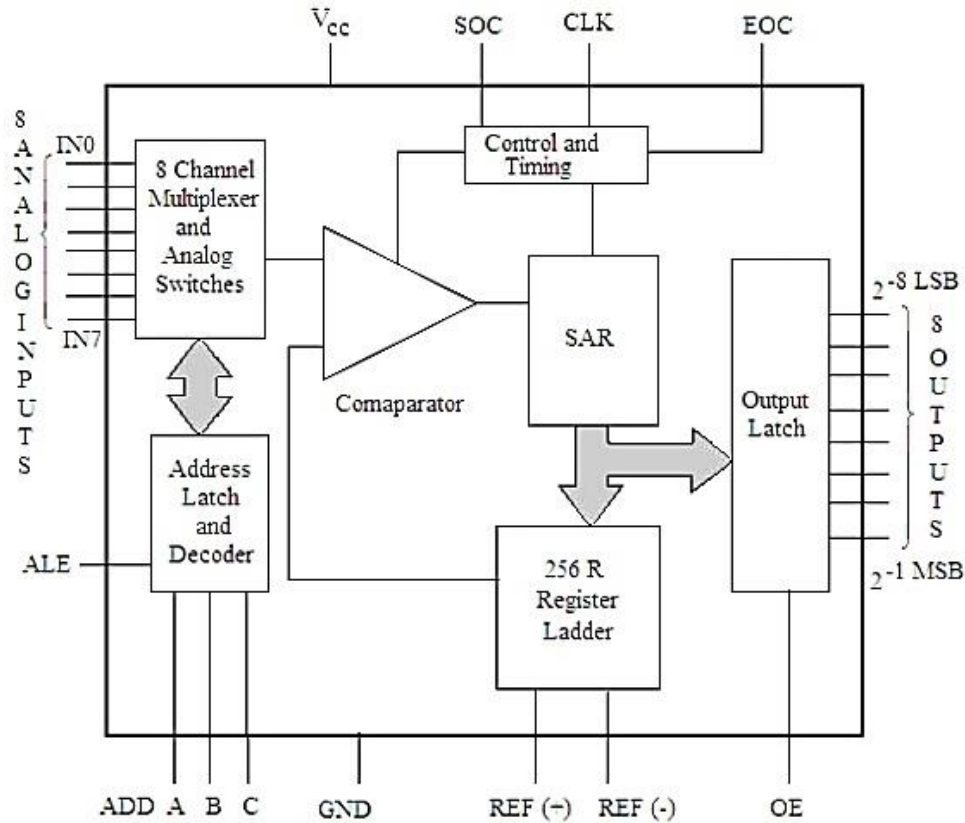


Figure 4.4.1 Architecture of ADC

[Source: "Microprocessor Architecture Programming and Application" by R.S. Gaonkar, page-]

Interfacing ADC with 8085 Microprocessor

To interface the ADC with 8085, we need 8255 Programmable Peripheral Interface chip with it. Let us see the circuit diagram of connecting 8085, 8255 and the ADC converter.

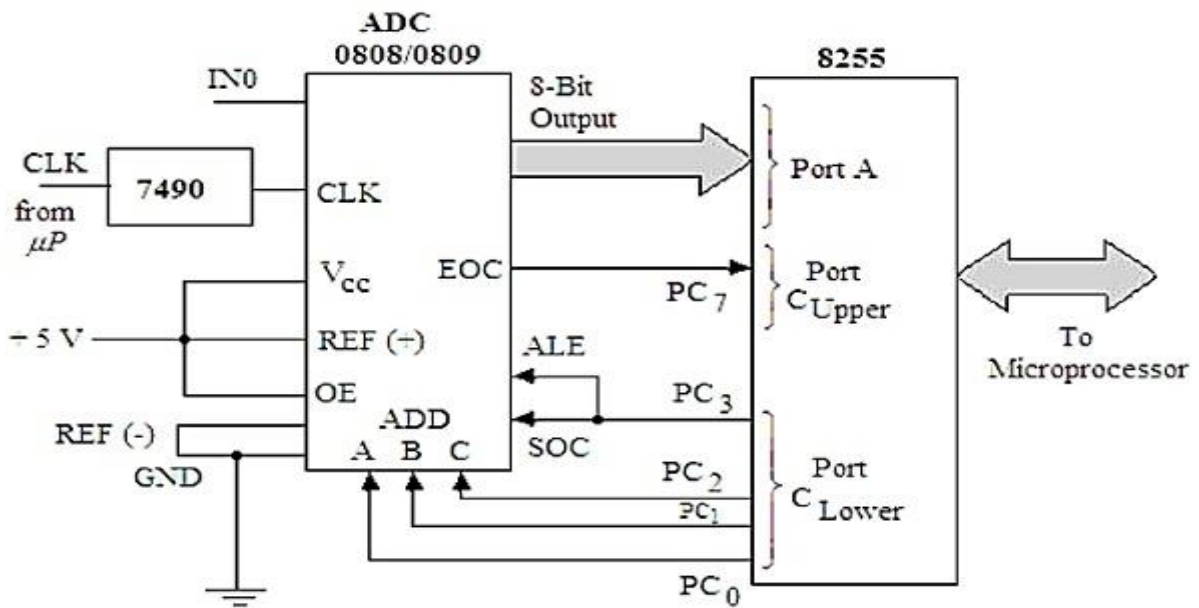


Figure 4.4.1 Interfacing ADC with 8085 Microprocessor

[Source: "Microprocessor Architecture Programming and Application" by R.S. Gaonkar, page-]

The PortA of 8255 chip is used as the input port. The PC7 pin of Port Cupper is connected to the End of Conversion (EOC) Pin of the analog to digital converter. This port is also used as input port. The Clower port is used as output port. The PC2-0 lines are connected to three address pins of this chip to select input channels. The PC3 pin is connected to the Start of Conversion (SOC) pin and ALE pin of ADC 0808/0809.

Now let us see a program to generate digital signal from analog data. We are using IN0 as input pin, so the pin selection value will be 00H

```
MVI A, 98H ; Set Port A and Cupper as input, CLower as output
OUT 03H ; Write control word 8255-I to control Wordregister
XRA A ; Clear the accumulator
OUT 02H ; Send the content of Acc to Port Clower to select
IN0
MVI A, 08H ; Load the accumulator with 08H
OUT 02H ; ALE and SOC will be 0
XRA A ; Clear the accumulator
OUT 02H ; ALE and SOC will be low.
READ: IN 02H ; Read from EOC (PC7)
RAL ; Rotate left to check C7 is 1.
JNC READ ; If C7 is not 1, go to READ
IN 00H ; Read digital output of ADC
STA 8000H ; Save result at 8000H
HLT ; Stop the program
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DAC Interfacing with 8085 Microprocessor

- DAC 0800 Features
- To convert the digital signal to analog signal a Digital-to-Analog Converter (DAC) has to be employed.
- The DAC will accept a digital (binary) input and convert to analog voltage or current.

- Every DAC will have "n" input lines and an analog output.
- The DAC require a reference analog voltage (V_{ref}) or current (I_{ref}) source.
- The smallest possible analog value that can be represented by the n-bit binary code is called resolution.
- The resolution of DAC with n-bit binary input is $1/2^n$ of reference analog value.
- The DAC0800 is an 8-bit, high speed, current output DAC with a typical settling time (conversion time) of 100 ns.
- It produces complementary current output, which can be converted to voltage by using simple resistor load.
- The DAC0800 require a positive and a negative supply voltage in the range of $\pm 5V$ to $\pm 18V$.

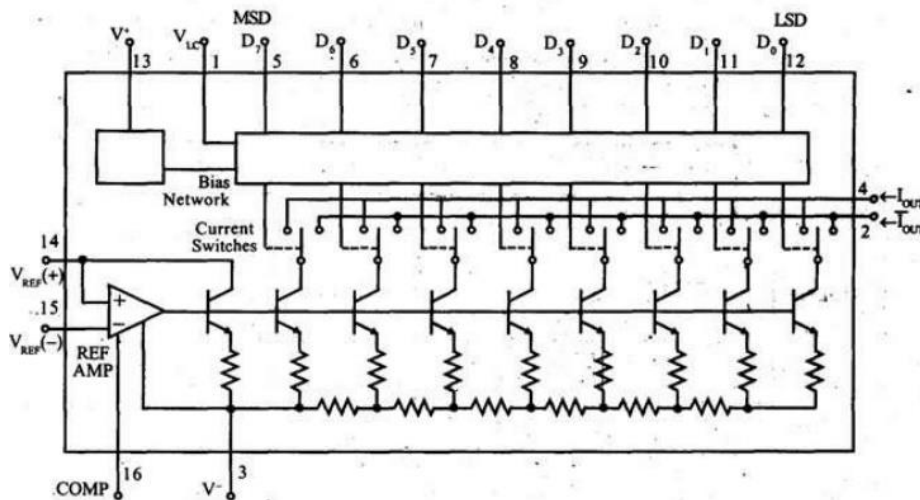


Fig 3.17 Circuit Diagram of DAC 0800

Figure 4.4.1 Circuit diagram of DAC 0800

[Source: "Microprocessor Architecture Programming and Application" by R.S. Gaonkar, page-]

- It can be directly interfaced with TTL, CMOS, PMOS and other logic families.
- For TTL input, the threshold pin should be tied to ground ($V_{LC} = 0V$).
- The reference voltage and the digital input will decide the analog output current, which can be converted to a voltage by simply connecting a resistor to output terminal or by using an op-amp I to V converter.
- The DAC0800 is available as a 16-pin IC in DIP.

Square Wave Generation Using DAC 0800:

ADDRESS	LABEL	MNEMONICS	OPCODE
	START	MVI A,00H OUT C8 CALL DELAY MVI A,FF OUT C8 CALL DELAY JMP START MVI B,05H MVI C,FF	
	DELAY	DCR C	
	L2	JNZ L1 DCR B	
	L1	JNL L2 RET	