YCCE, Nagpur

MGI

DAC interfacing with 8051

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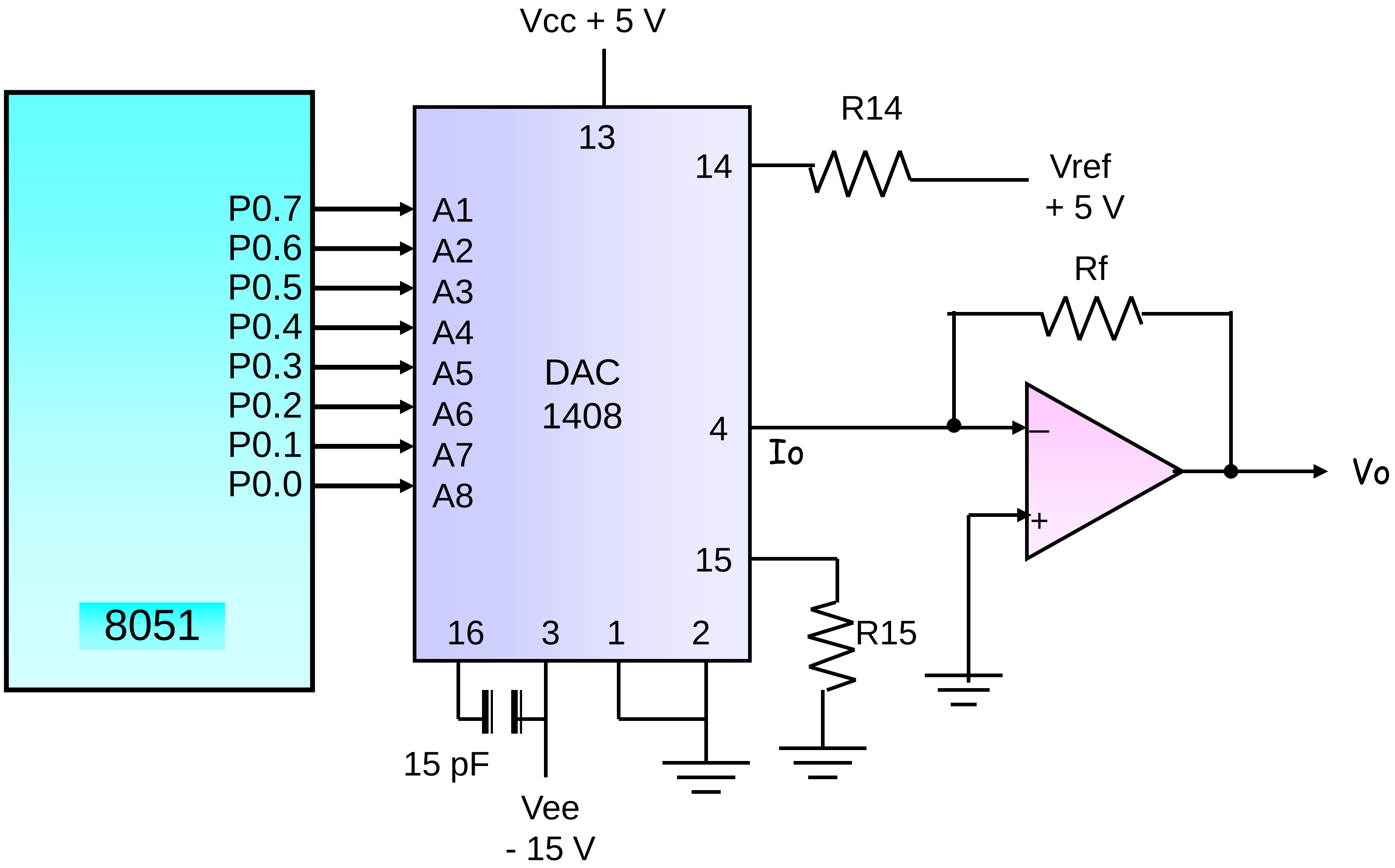
Interfacing 8 bit DAC (Unipolar O/P)



Io = Vref/R14 * (A1/2 + A2/4 + A3/8 + A4/16 + A5/32 + A6/64 + A7/128 + A8/256)

Vo = Io * Rf

Interfacing 8 bit DAC (cont..)

Iref = Vref / R14 = Maximum output current
Suppose Vref = 5 V, R14 = 2.5 K then Iref = 5 / 2.5 = 2 mA
Io (max) = 2 mA, Vo = Io * Rf
If Rf = 2.5 K , then **Vo (max) = 2 mA * 2.5 K = 5 V**

If Rf = 5 K , then **Vo (max) = 2 mA * 5 K = 10 V**

e.g. If binary input A1 A2 A3 A4 A5 A6 A7 A8 = 11111111, then
Io = 5/2.5K * (1/2 + 1/4 + 1/8 + 1/16 + 1/32 + 1/64 + 1/128 + 1/256)
Io = 5/2.5K * (255/256) ~ 2 mA

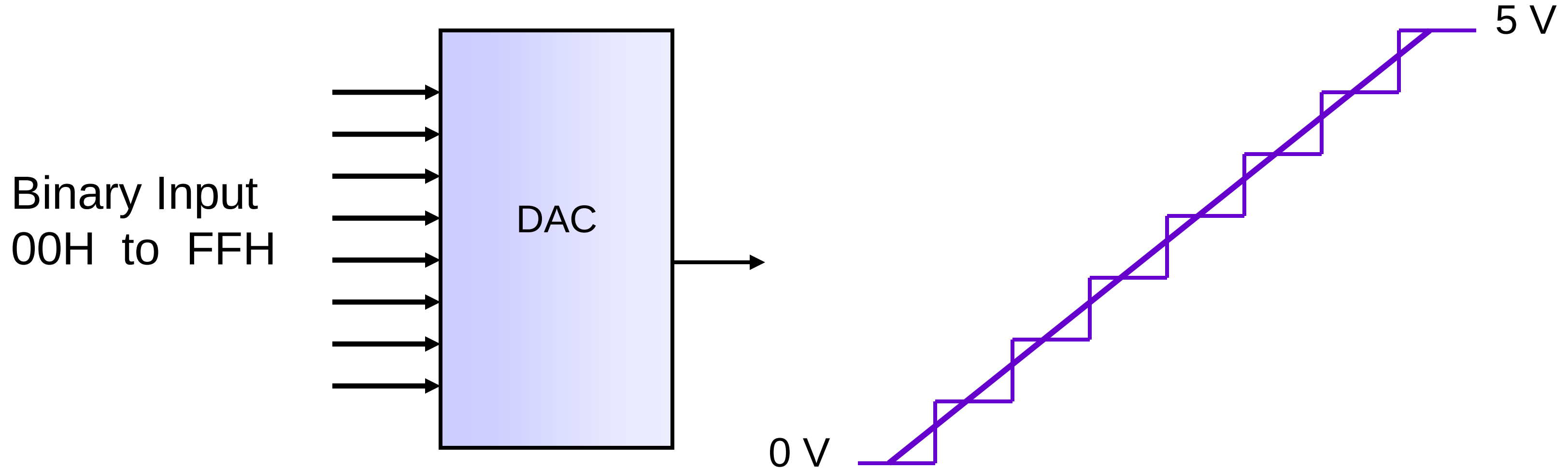
e.g. If binary input A1 A2 A3 A4 A5 A6 A7 A8 = 10000000, then
Io = 5/2.5K * (1/2 + 0/4 + 0/8 + 0/16 + 0/32 + 0/64 + 0/128 + 0/256)
Io = 5/2.5K * (1/2) ~ 1 mA

e.g. If binary input A1 A2 A3 A4 A5 A6 A7 A8 = 00000011, then
Io = 5/2.5K * (0/2 + 0/4 + 0/8 + 0/16 + 0/32 + 0/64 + 1/128 + 1/256)
Io = 5/2.5K * (3/256) ~ 0.02343 mA

e.g. If binary input A1 A2 A3 A4 A5 A6 A7 A8 = 00000000, then
Io = 5/2.5K * (0/2 + 0/4 + 0/8 + 0/16 + 0/32 + 0/64 + 0/128 + 0/256)
Io = 5/2.5K * (0) ~ 0mA

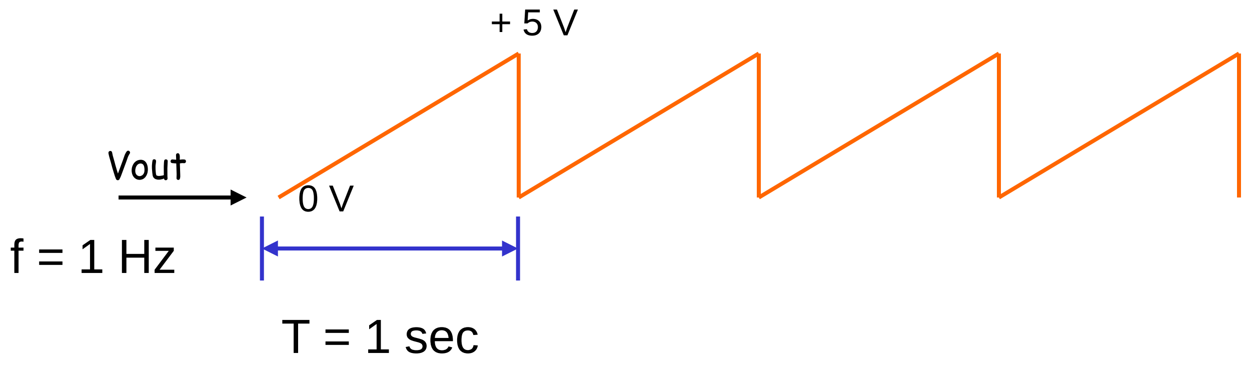
DAC input / output table (Unipolar)

Input		Rf =2.5 K	Output
Binary	Io	Vo = Io * Rf	Vo
00H	0 mA	0 * 2.5	0 V
01H	0.0078 mA	0.0078 * 2.5	19.5 mV
03H	0.02343 mA	0.02343 * 2.5	58.5 mV
7FH	1 mA	1 * 2.5	2.5 V
FFH	2 mA	2 * 2.5	5 V



Problem #1

Q. Write program to generate saw-tooth wave using DAC as shown.

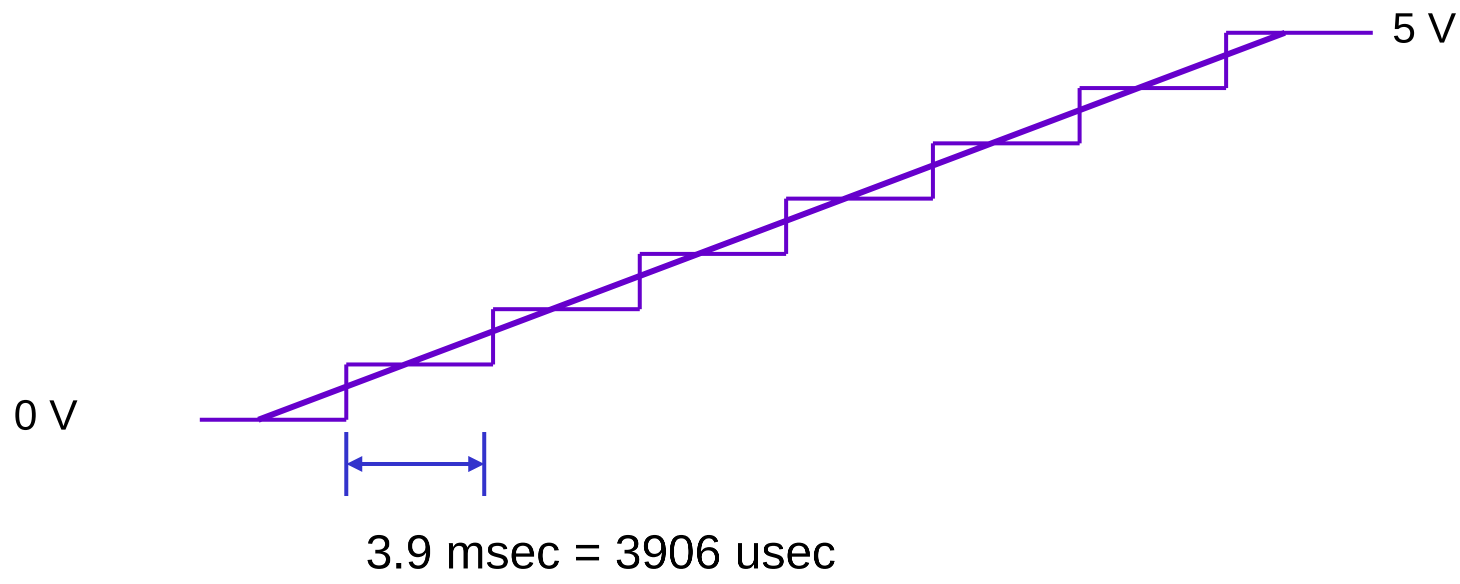


T = 1/f = 1 sec

0 V to 5 V there are 256 steps (8 bit input)

Hence Delay per step = 1 sec/ 256 = 1000 msec/ 256
= 3.906 msec

Problem #1…



Delay Program Calculation of N

No. of m/c cycles = 1 + N1 ∗ (1 + 2 ∗ N2 + 2)
= 3906

Assume N1 = 8, then N2 = ?

1 + 8 ∗ (1 + 2 ∗ N2 + 2) =3906

N2 = 243

Problem #1…

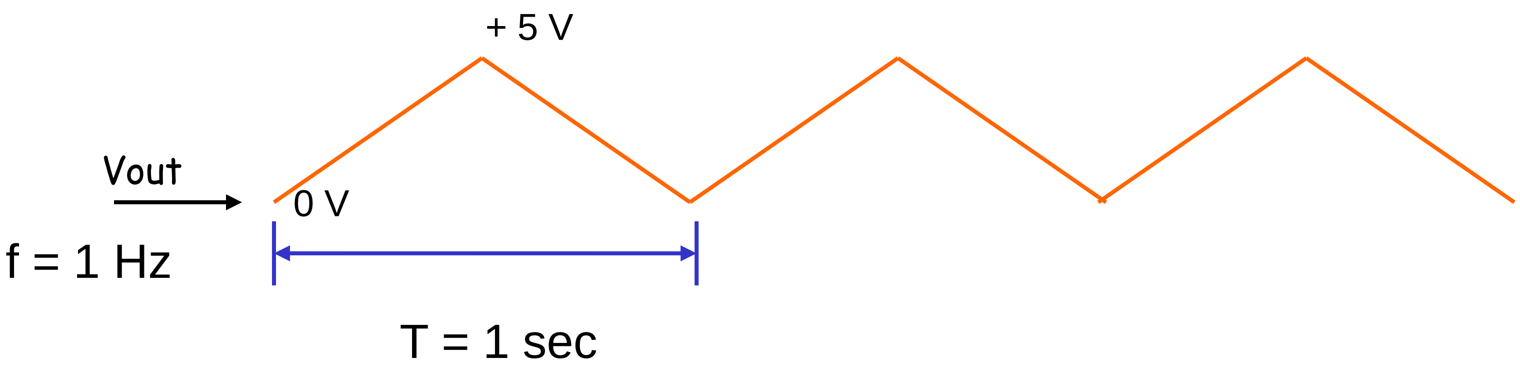
- Program:

```
        MOV  A, #00H          ; Clear Accumulator
LOOP:   MOV  P0, A            ; Send data to DAC
        INC  A                ; Increment Acc
        ACALL  DELAY          ; Delay per step
        SJMP  LOOP            ; Repeat

; Subroutine for Delay of 3.906 msec
DELAY: MOV R1, #08H           ; N1=8
L2:     MOV R2, #F3H          ; N2=243
L1:     DJNZ R2, L1
        DJNZ R1, L2
        RET
```

Problem # 2

Q. Write program to generate triangular wave using DAC as shown.

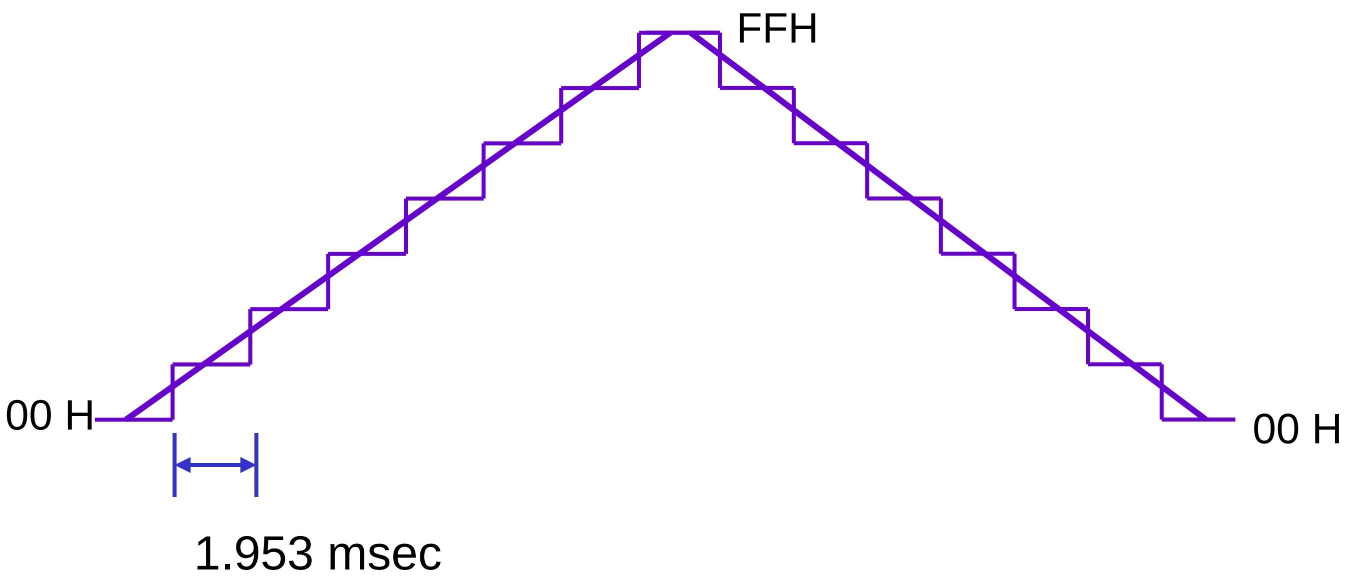


T = 1/f = 1 sec

0 V to 5 V & then 5 V to 0 V there are 256 + 256 steps (8 bit input)

Hence Delay per step = 1 sec/ 512 = 1000 msec/ 512
= 1.953 msec

Problem #2…



Delay Program Calculation of N

No. of m/c cycles = 1 + N1 ∗ (1 + 2 ∗ N2 + 2)
= 1953

Assume N1 = 4, then N2 = ?

1 + 4 ∗ (1 + 2 ∗ N2 + 2) = 1953

N2 = 243

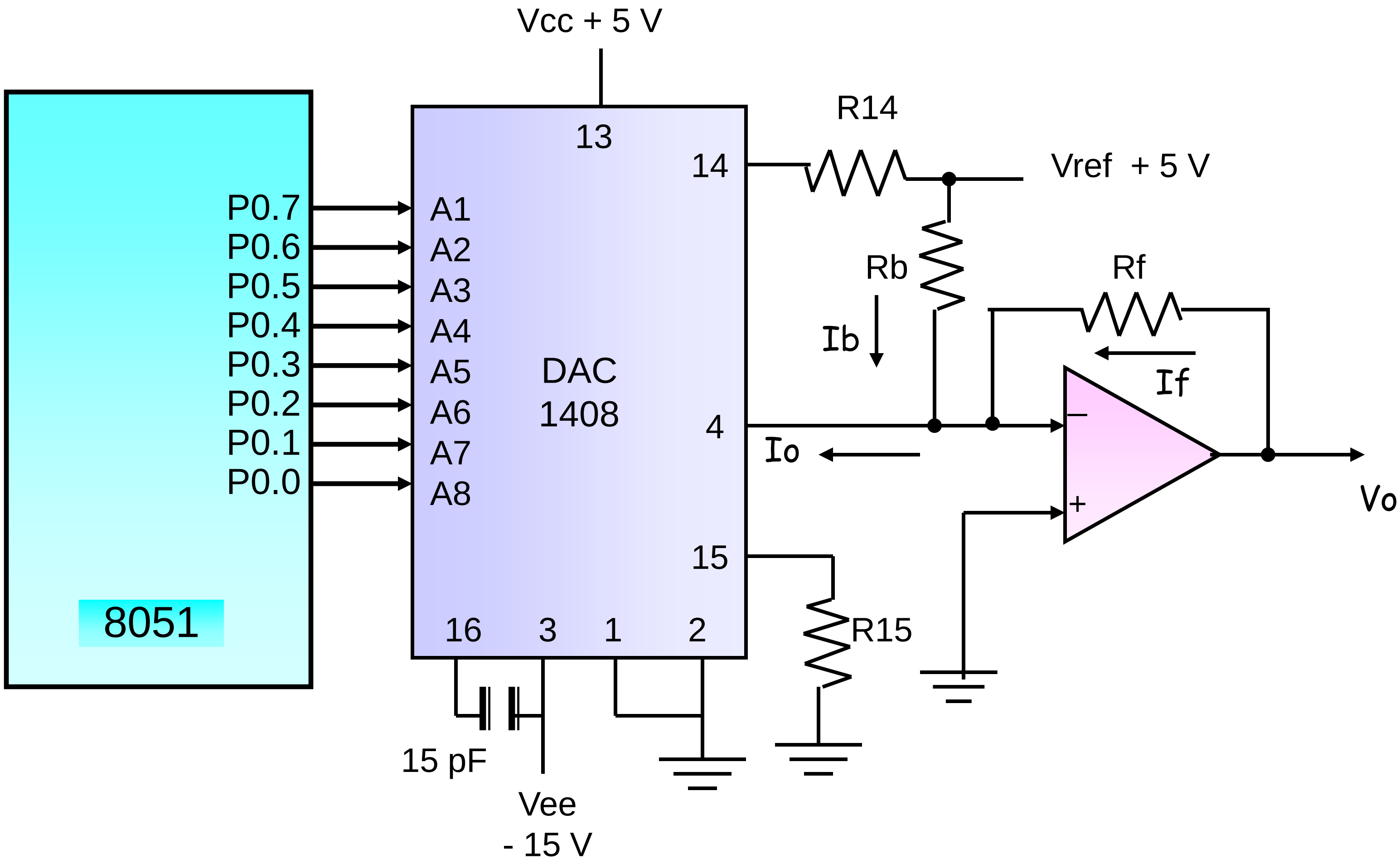
Problem #2…

- Program:

```
        MOV  A, #00H          ; Clear Accumulator
L3:     MOV  P0, A            ; Send data to DAC
        INC  A                ; Increment Acc
        ACALL  DELAY          ; Delay per step
        CJNE A, #FFH, L3      ; Repeat if not FFH
L4:     MOV  P0, A            ; Send data to DAC
        DEC  A                ; Decrement Acc
        ACALL  DELAY          ; Delay per step
        CJNE A, #00H, L4      ; Repeat if not 00H
        SJMP L3

; Subroutine for Delay of 1.953 msec
DELAY: MOV R1, #04H           ; N1=4
L2:     MOV R2, #F3H          ; N2=243
L1:     DJNZ R2, L1
        DJNZ R1, L2
        RET
```

Interfacing 8 bit DAC (Bipolar O/P)



Io = Vref/R14 * (A1/2 + A2/4 + A3/8 + A4/16 + A5/32 + A6/64 + A7/128 + A8/256)

Io = If + Ib,   If = Io - Ib,   Vo = If * Rf,   Vo = (Io – Ib) * Rf

DAC input / output table (Bipolar)

Iref = Vref / R14 = Maximum output current
Suppose Vref = 5 V, R14 = 2.5 K then Iref = 5 / 2.5 = 2 mA
Io (max) = 2 mA
Ib = Vref / Rb = Bias current
Suppose Vref = 5 V, Rb = 5 K then **Ib = 5 / 5 = 1 mA**
If = Io – Ib = **Io – 1 mA**
Vo = (Io – 1 mA) * Rf

Input		If	Rf =2.5 K	**Output**
Binary	Io	If = Io-1mA	Vo = Io * Rf	Vo
00H	0 mA	- 1 mA	-1 * 2.5	-2.5 V
01H	0.0078 mA	- 0.992 mA	-0.992 * 2.5	- 2.48 V
03H	0.02343 mA	- 0.976 mA	- 0.976 * 2.5	- 2.44 V
7FH	1 mA	0 mA	0 * 2.5	0 V
FFH	2 mA	+ 1 mA	1 * 2.5	+ 2.5 V

Thank You!!