Abstract

In this experiment Digital-to-Analog converter of 8086 microprocessor were introduced. Four wave shapes namely Sawtooth, Triangular, Square and Sine wave were drawn on a oscilloscope with the output port of MTS-86c training kit.

1 Introduction

In general digital-to-analog converter is used to convert a digital output from a computer to an analog value. In this lab experiment the objective is:

- To familiarize with interfacing of Digital -to-Analog (DAC) converter with 8086.

2 Pre-Lab Homework

- The sample codes were ran and values were observed.

3 Apparatus

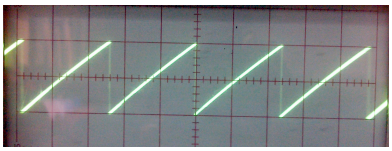
1. MDA-8086 Microprocessor Kit interfaced with PC
2. MTS-86C Microprocessor Kit
3. EMU8086.

4 Precautions

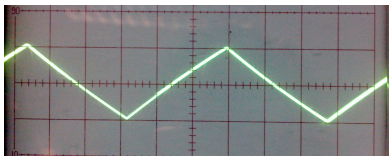
1. The data in MTS-86c with care.
2. In case of the 16 bit numbers the last 8 bits should be entered first.

5 Result

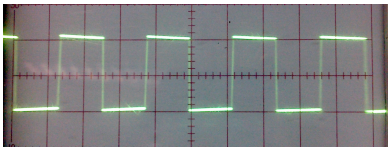
The oscilloscope output of the given codes are as follows:



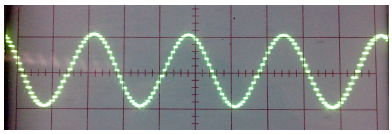
(a) Sawtooth wave



(b) Triangular Wave



(c) Square Wave



(d) Sine Wave

Figure 1: Oscilloscope output of 3FD8H port

6 Answer to Report Question

1. Write a code to plot the following wave shape.

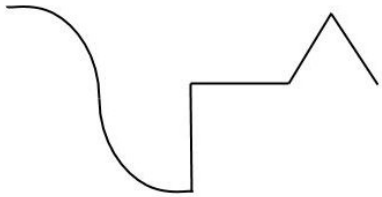


Figure 2: Figure for question.

```
DAC EQU 3FD8H

CODE SEGMENT

    ASSUME CS: CODE, DS: CODE

    MOV AX, CS
    MOV DS, AX
    MOV DX, DAC

    L1:
    MOV DI, 0
    MOV BL, 36
```

```
        L2:
        MOV AL, SINE[DI]
        OUT DX, AL
        INC DI
        DEC BL
        JNZ L2
        JMP L1

        HLT

        SINE DB 254, 252, 246, 237, 224, 209, 191, 170, 149
        DB 127, 105, 84, 64, 45, 30, 17, 8, 2
        DB 0, 127, 127, 127, 127, 127, 127, 127, 127
        DB 147, 177, 207, 237, 254, 237, 207, 177, 147
        CODE ENDS
    END
```

7 Discussion

- One or two mistakes were corrected by re-entering the value on the training kit.
- For the sine wave the array values were rechecked as there were many values.
- Probes of the oscilloscope were connected to the right port.
- Oscilloscope were calibrated before using to display the output.
- As there were a limited number of values in the array the sine wave was not very smooth.

8 Conclusions

After completing the process the output in the oscilloscope for each program were as expected according to the digital value. So, this experiment was successful.

References

[1] 8086 instructions. `http://www.electronics.dit.ie/staff/tscarff/8086_instruction_set/8086_instruction_set.html#SHL`. (Visited on 06/09/2015).

[2] Instruments techno test inc. http://catalogue.techno-test.com/products/6-Educational_Products/38-Electricity___Electronics/354-K_H_MTS_86C-MTS_86C_8086_Microcomputer_Trainer.html. (Visited on 06/02/2015).

[3] A.P. Malvino and J.A. Brown. *Digital Computer Electronics*. McGraw-Hill electricity & electronics series. Glencoe, 1992.

9 Appendices

9.1 Sawtooth Wave

```
 1 = 3FD8                DAC EQU 3FD8H
 2
 3 0000                  CODE SEGMENT
 4
 5                           ASSUME CS: CODE, DS: CODE
 6
 7 0000  32 C0               XOR AL, AL
 8 0002  BA 3FD8             MOV DX, DAC
 9
10 0005                      L1:
11 0005  EE                 OUT DX, AL
12 0006  FE C0              INC AL
13 0008  EB FB              JMP L1
14
15 000A  F4                 HLT
16 000B                     CODE ENDS
17                      END
```

9.2 Triangular Wave

```
 1 = 3FD8                DAC EQU 3FD8H
 2
 3 0000                  CODE SEGMENT
 4
 5                           ASSUME CS: CODE, DS: CODE
 6
 7 0000  BA 3FD8             MOV DX, DAC
 8 0003  32 C0               XOR AL, AL
 9 0005                      L1:
10 0005  EE                 OUT DX, AL
```

```
11  0006   FE C0          INC AL
12  0008   3C FF          CMP AL, 0FFH
13  000A   75 F9          JNZ L1
14
15  000C                  L2:
16  000C   EE             OUT DX, AL
17  000D   FE C8          DEC AL
18  000F   22 C0          AND AL, AL
19  0011   75 F9          JNZ L2
20  0013   EB F0          JMP L1
21
22
23  0015   F4             HLT
24  0016                  CODE ENDS
25                        END
```

9.3 Square Wave

```
 1  = 3FD8                DAC EQU 3FD8H
 2
 3  0000                  CODE SEGMENT
 4
 5                        ASSUME CS: CODE, DS: CODE
 6
 7  0000   32 C0          XOR AL, AL
 8  0002   BA 3FD8        MOV DX, DAC
 9
10  0005                  L1:
11  0005   EE             OUT DX, AL
12  0006   B9 0064        MOV CX, 100
13  0009   E2 FE          LOOP $
14  000B   F6 D0          NOT AL
15  000D   EB F6          JMP L1
16
17  000F   F4             HLT
18  0010                  CODE ENDS
19                        END
```

9.4 Sine Wave

```
 1  = 3FD8                DAC EQU 3FD8H
 2
```

```
 3 0000                                 CODE SEGMENT
 4
 5                                          ASSUME CS: CODE, DS: CODE
 6
 7 0000  8C C8                              MOV AX, CS
 8 0002  8E D8                              MOV DS, AX
 9 0004  BA 3FD8                            MOV DX, DAC
10
11 0007                                    L1:
12 0007  BF 0000                           MOV DI, 0
13 000A  B3 24                             MOV BL, 36
14
15 000C                                    L2:
16 000C  8A 85 0019 R                      MOV AL, SINE[DI]
17 0010  EE                                OUT DX, AL
18 0011  47                                INC DI
19 0012  FE CB                             DEC BL
20 0014  75 F6                             JNZ L2
21 0016  EB EF                             JMP L1
22
23 0018  F4                                HLT
24
25 0019  7F 95 AA BF D1 E0                 SINE DB 127, 149, 170, 191, 209, 22
                                           4, 237, 246
26       ED F6
27 0021  FC FE FC F6 ED E0                 DB 252, 254, 252, 246, 237, 224, 20
                                           9, 191
28       D1 BF
29 0029  AA 95 7F 69 54 40                 DB 170, 149, 127, 105, 84, 64, 45,
                                           30
30       2D 1E
31 0031  11 08 02 00 02 08                 DB 17, 8, 2, 0, 2, 8, 17, 30, 45, 6
                                           4, 84, 105
32       11 1E 2D 40 54 69
33
34 003D                                    CODE ENDS
35                                     END
```