Embedded System on AVR Microcontroller (ATMEGA32)

Exp6: Waveform Generation by ATMEGA32 through Digital to Analog Converter DAC0808 and LM358

Submitted by
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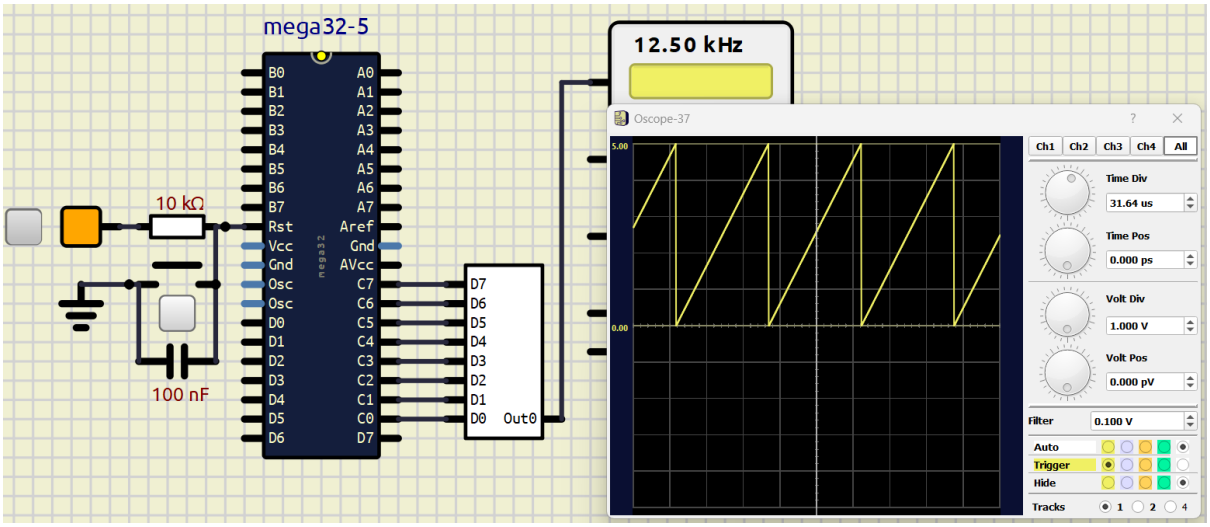
- **Sawtooth Positive Slope Waveform Generation with ATMEGA32 and DAC on SimulIDE**

```
// Sawtooth Positive Slope Waveform Generation

.INCLUDE "M32DEF.INC"
.ORG 0x0000

LDI R16,HIGH(RAMEND)
OUT SPH,R16
LDI R16,LOW(RAMEND)
OUT SPL,R16

LDI R16,0xFF
OUT DDRC,R16

LDI R16,0x00
LOOP: OUT PORTC,R16
      INC R16
      JMP LOOP
```



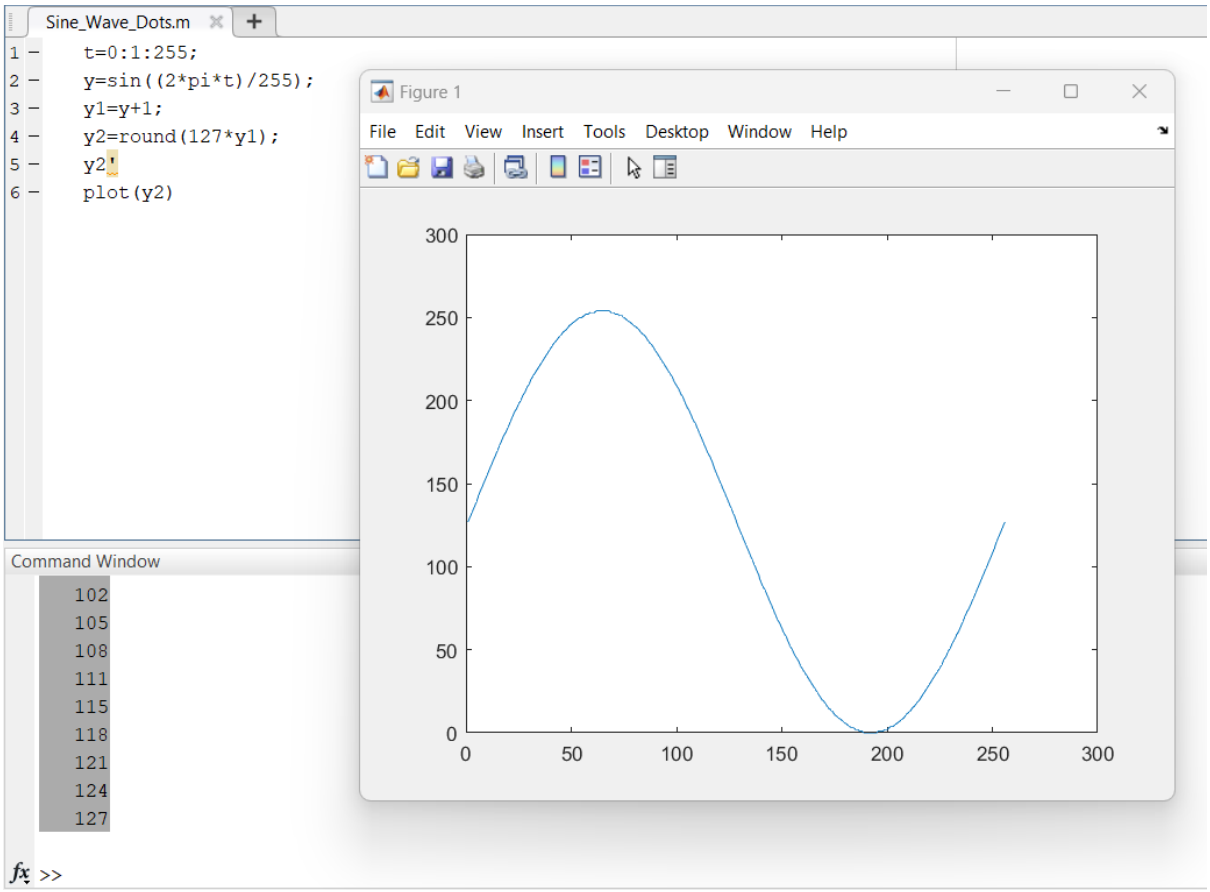
Make the above circuit to Simulate.

Class Assignment 1: Write Assembly Code for Sawtooth negative slope waveform generation with ATMEGA32 and DAC on SimulIDE.

Class Assignment 2: Write Assembly Code for Triangular waveform generation with ATMEGA32 and DAC on SimulIDE.

- **C code for Sine Wave Generation with ATMEGA32 and DAC on SimulIDE.**

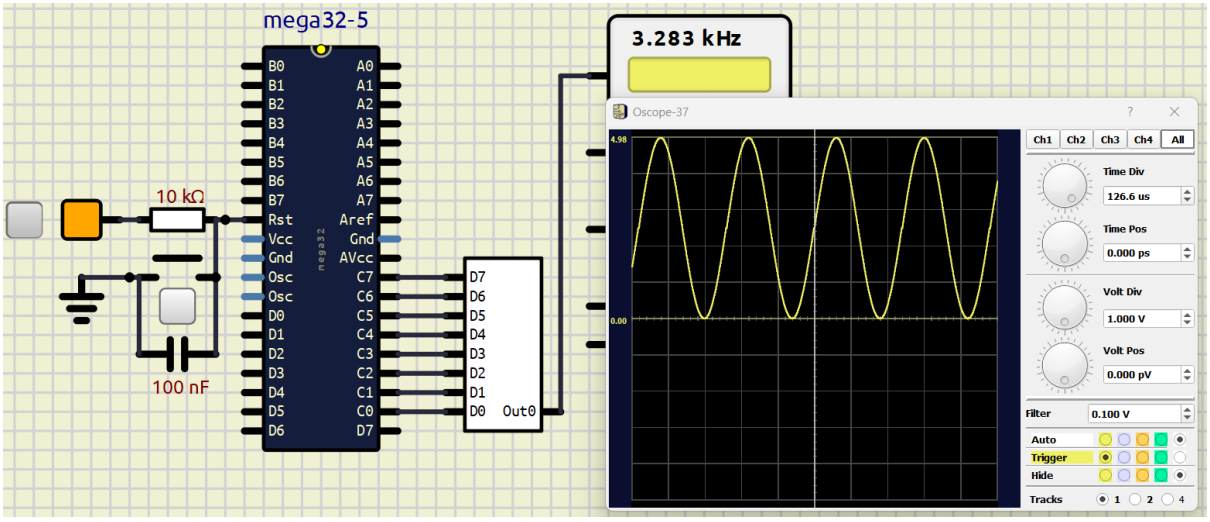
Use MATLAB to get the Sine Wave Dots.



The copy the column to make it comma separated value form below website and use it inside an array.
https://convert.town/column-to-comma-separated-list

```
// Sine wave in C

#include <avr/io.h>
#define F_CPU 1000000
#include <util/delay.h>


int main(void)
{
	DDRC=0xFF;
	int i;
	int a[]={127,   130,   133,   136,   139,   143,   146,   149,
152,   155,   158,   161,   164,   167,   170,   173,   176,   179,
```

```
181,    184,    187,    190,    193,    195,    198,    200,    203,    205,
208,    210,    213,    215,    217,    219,    221,    223,    225,    227,
229,    231,    233,    235,    236,    238,    239,    241,    242,    243,
245,    246,    247,    248,    249,    250,    250,    251,    252,    252,
253,    253,    253,    254,    254,    254,    254,    254,    254,    254,
253,    253,    252,    252,    251,    251,    250,    249,    248,    247,
246,    245,    244,    243,    241,    240,    239,    237,    235,    234,
232,    230,    228,    226,    224,    222,    220,    218,    216,    214,
211,    209,    207,    204,    202,    199,    196,    194,    191,    188,
186,    183,    180,    177,    174,    171,    168,    166,    163,    159,
156,    153,    150,    147,    144,    141,    138,    135,    132,    129,
125,    122,    119,    116,    113,    110,    107,    104,    101,     98,
95,     91,     88,     86,     83,     80,     77,     74,     71,     68,
66,     63,     60,     58,     55,     52,     50,     47,     45,     43,
40,     38,     36,     34,     32,     30,     28,     26,     24,     22,
20,     19,     17,     15,     14,     13,     11,     10,      9,      8,
7,      6,      5,      4,      3,      3,      2,      2,      1,      1,
0,      0,      0,      0,      0,      0,      0,      1,      1,      1,
2,      2,      3,      4,      4,      5,      6,      7,      8,      9,
11,     12,     13,     15,     16,     18,     19,     21,     23,     25,
27,     29,     31,     33,     35,     37,     39,     41,     44,     46,
49,     51,     54,     56,     59,     61,     64,     67,     70,     73,
75,     78,     81,     84,     87,     90,     93,     96,     99,    102,
105,    108,    111,    115,    118,    121,    124,    127};
    while (1)
    {
            for(i=0;i<256;i++)
            {
                  PORTC=a[i];
            }
    }
}
```

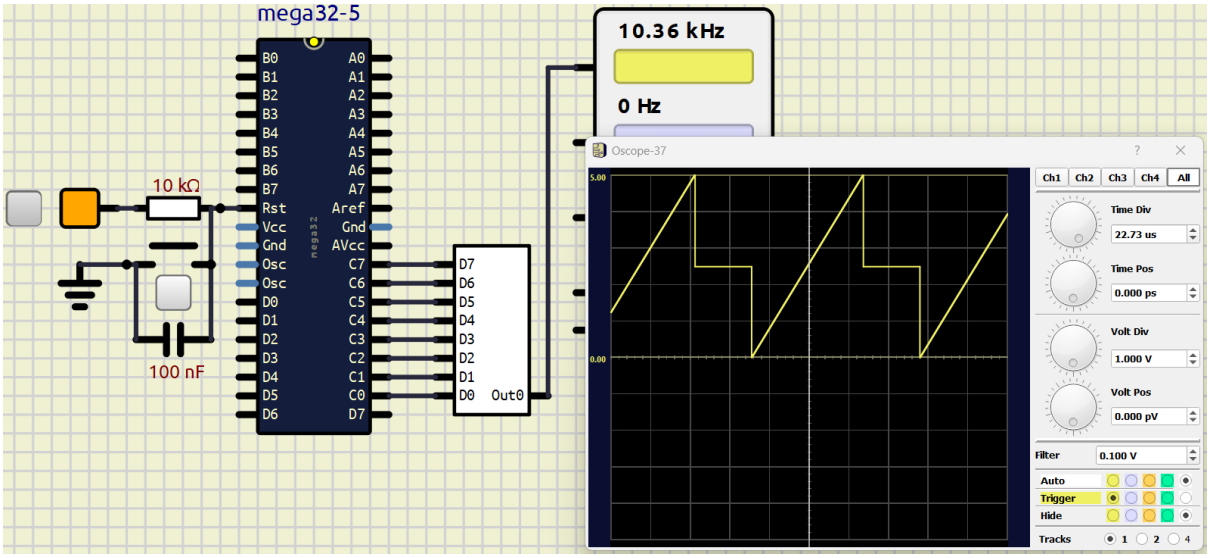


Make the above circuit to Simulate.

Class Assignment 3: Write Assembly Code for Sine waveform generation with 51 Digital Dots in a Time Period with ATMEGA32 and DAC on SimulIDE.

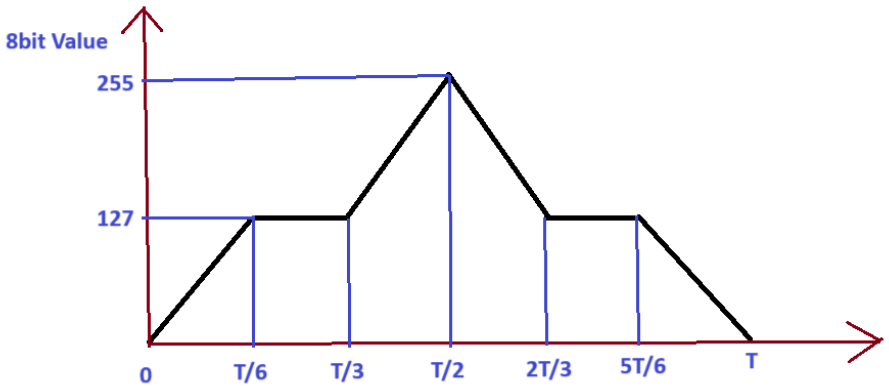
- **Example of Miscellaneous Waveform Generation**

```
// Miscellaneous Waveform 1

.INCLUDE "M32DEF.INC"
.ORG 0x0000

LDI R16,HIGH(RAMEND)
OUT SPH,R16
LDI R16,LOW(RAMEND)
OUT SPL,R16

LDI R16,0xFF
OUT DDRC,R16

MAIN:       LDI R16,0x00
            LOOP1:      OUT PORTC,R16
                        INC R16
                        BRNE LOOP1
            LDI R16,0x7F
            LDI R17,0x7F
            LOOP2:      OUT PORTC,R16
                        INC R17
                        BRNE LOOP2
            JMP MAIN
```



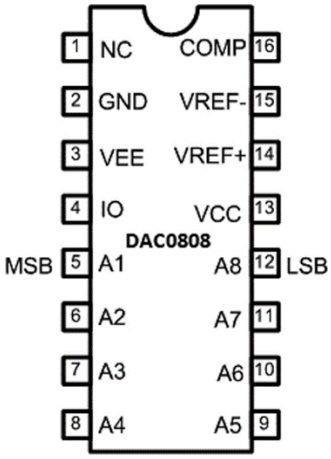
Make the above circuit to Simulate.

Class Assignment 4: Write Assembly Code to generate the Periodic Waveform given below.



- # Hardware for Waveform Generation with ATMEGA32, DAC0808 and LM358

Pinout of DAC0808



Datasheet Link: https://www.ti.com/lit/gpn/DAC0808

Typical Application

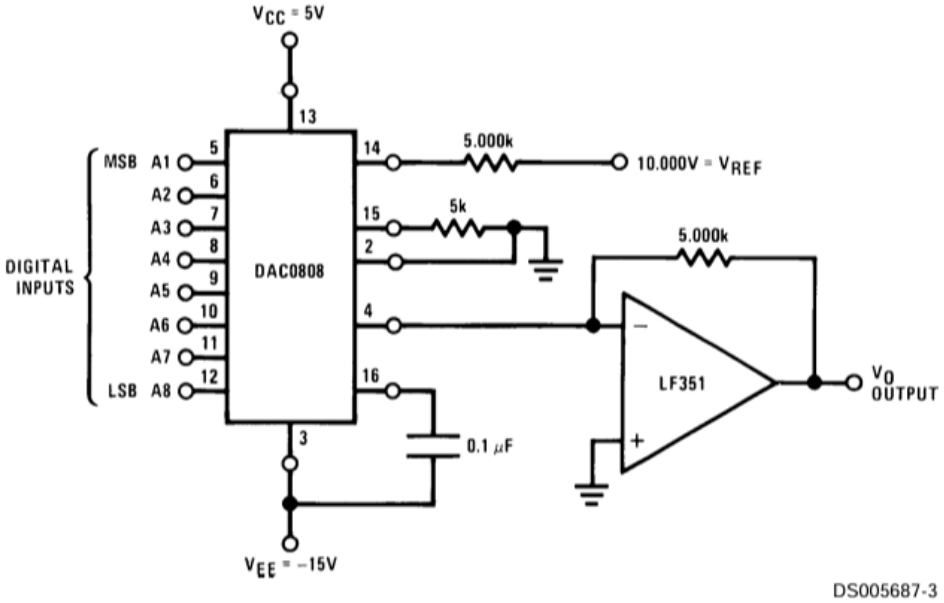
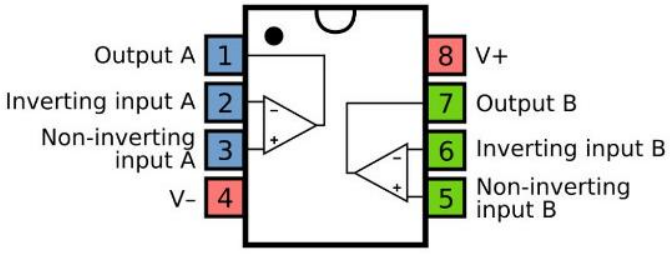


FIGURE 1. +10V Output Digital to Analog Converter

Pinout of LM358



LM358 DIP package