DAC Lab Exercise:   
Signal Generator

# Overview

In this project you will use the DAC to generate various signals which can be viewed on an oscilloscope or heard through a speaker. Use the AnalogWaveGen Project file provided.

Instructor note: Items in bright red are solutions to be deleted before posting for students.

Also, instructor can refer to project TimerLab for a detailed generator implementations.

# Details

## Hardware

### Connections

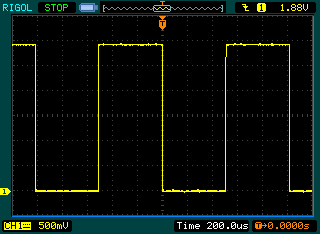
Connect the oscilloscope probe to the PA5 signal on MCU board as shown in table below. This matches the pin used in the project code. Connect the oscilloscope ground to GND on the MCU board.

# Procedure

For these experiments you will configure the lab code by changing the behavior of count which is the parameter passed to the DHR12R2 when it is called by main. Valid options are SQUARE, RAMP and SINE. Decide your own code and parameters and answer the following questions below.

## Square Wave

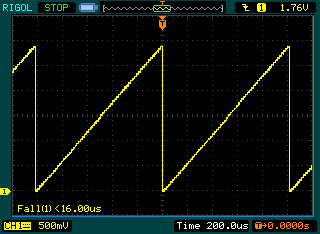
Configure the code to generate a square wave. Compile and download the software. Use the oscilloscope to observe the output.



1. What is the minimum output voltage? \_\_\_\_\_\_\_\_\_\_\_\_\_\_V Around 0.053V
2. What is the maximum output voltage? \_\_\_\_\_\_\_\_\_\_\_\_\_\_V Around 2.915V
3. What is the rise time of the output signal? \_\_\_\_\_\_\_\_\_ ns
4. What is the fall time of the output signal? \_\_\_\_\_\_\_\_\_ns
5. What is the period of the output signal? \_\_\_\_\_\_\_\_\_\_\_ ms
6. Does the result match your code? If not, what is the reason?

## Ramp Wave

Configure the code to generate a ramp wave. Compile and download the software. Use the oscilloscope to observe the output.



1. Why is the rising edge of the ramp wave not smooth? The DAC has 12 bits of resolution, but the resulting waveform is jagged.

The sampling frequency (set in part by the number of steps) so low that the signal changes by a large amount between each sample.

1. How can you smooth the rising edge in hardware?

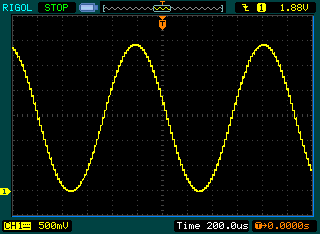
Add a low-pass RC filter.

1. How can you smooth the rising edge in software?

Increase the number of steps in the ramp generation code.

## SINe Wave

Configure the code to generate a sine wave. Compile and download the software. Use the oscilloscope to observe the output. You can also use the math.h library



1. Experiment with the code to determine the maximum frequency sine wave which can be generated.

## Optional

1. Use the Discovery DAC noise generation to make a noise signal and observe the signal, to what extend it can be considered as pattern-less? Is it real noise or too artificial to be recognized as noise?
2. Use the Discovery DAC triangle generation to make triangle signal.