***Efficient Embedded Course***

**DAC LAB EXERCISE:**

**SIGNAL GENERATOR**

**Issue 1.0**

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# 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.

# Details

## Hardware

A picture containing text, electronics, circuit

Description automatically generated

Figure 1. DiscoveryF4 pinout.

### Connections

Connect the oscilloscope probe to the DAC output signal on MCU board as shown in table below. This matches the pin used in the furnished code. Connect the oscilloscope ground to ground on the MCU board.

Table 1. Switch signals and connections

|  |  |  |  |
| --- | --- | --- | --- |
| Signal Name | Description | Direction | MCU |
| DAC\_OUT | DAC output | Output from MCU | PA5 |
| GND | Ground | Power |  |

# Procedure

For these experiments you will configure the lab code by changing the last parameter passed to the function tone\_play when it is called by main. Valid options are SQUARE, RAMP and SINE.

## 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
2. What is the maximum output voltage? \_\_\_\_\_\_\_\_\_\_\_\_\_\_V
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

## 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 8 bits of resolution, but the resulting waveform is jagged.
2. How can you smooth the rising edge in hardware?
3. How can you smooth the rising edge in software?

## SINe Wave

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

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