

DAC_with_Arduino -- Overview



OBJECTIVES

After performing this lab exercise, learner will be able to:

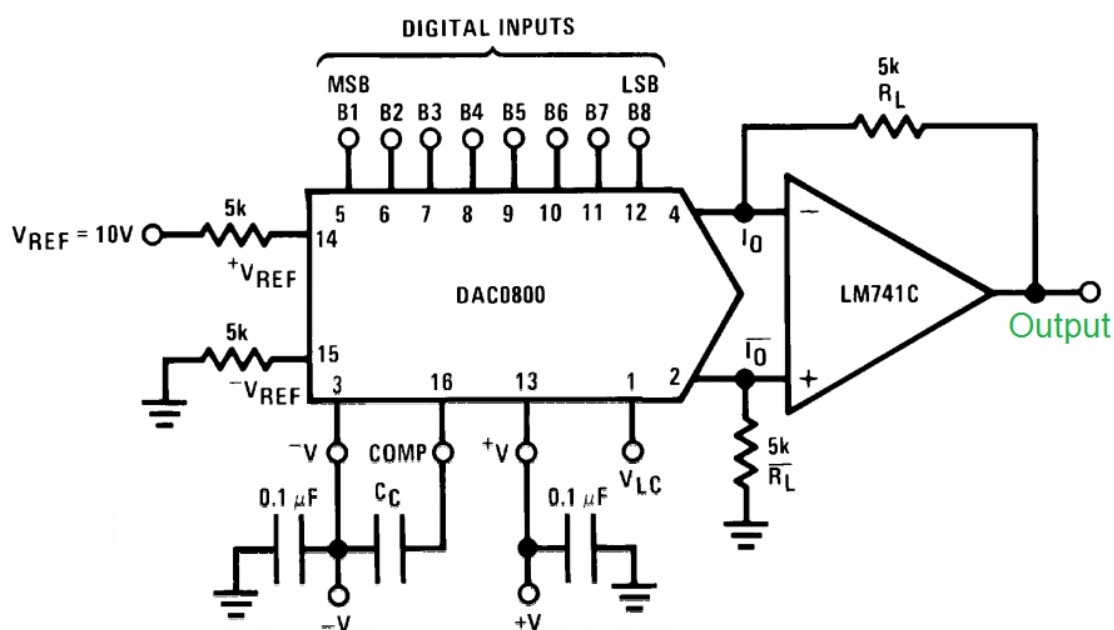
- Program Arduino board to generate digital signals
- Convert the digital signals (bits) into analog signal using DAC
- Capture and display the signal from given Device Under Test (DUT)
- Measure the analog voltage equivalent to given digital code and verify Digital-to-Analog Conversion.

EQUIPMENT

To carry out this experiment, you will need:

- TBS1KB-Edu Digital Oscilloscope from Tektronix
- Arduino Uno board
- Voltage probe (provided with oscilloscope) / BNC cables
- DAC 0800 and Opamp.
- Simple circuit components – Resistor / capacitors

CIRCUIT DIAGRAM



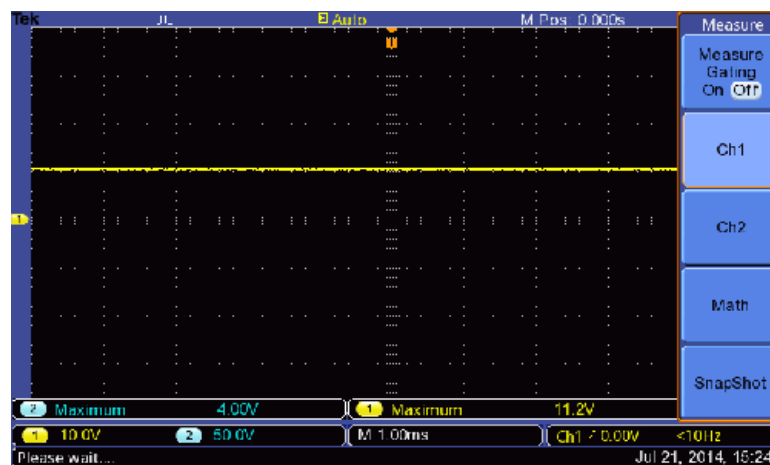
THEORY

- DAC stands for digital to analog converter, which is mainly used in various communication systems.
- There are several ways to convert digital signal to analog. One of the ways is using DAC0800 IC.
- It converts 8 bit digital signal into analog output. Analog value is calculated using the formula

$$V_{out} = V_{ref} \times \left(\frac{2n - 255}{256} \right) \text{ where } n \text{ is the input code.}$$

Observation:

Input (B1 B2 B3 B4 B5 B6 B7 B8)	Theoretical Value (in volts)	Observed Value (in volts)
00000000	-4.96	-5
01000000	-9.961	-10
11001010	5.976	6
11100110	8.01	8
11111111	9.961	10



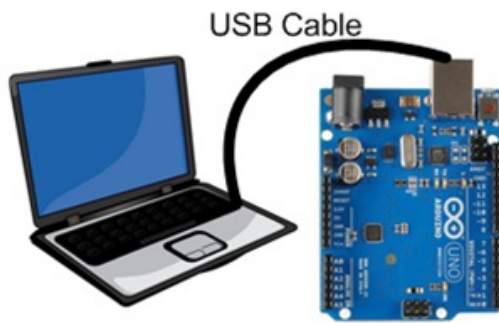
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DAC_with_Arduino -- Procedures

Step 1

DUT / SOURCE SETUP

- Ensure you have Arduino IDE (software to program the Arduino boards) installed on your computer.
- Connect the Arduino board to PC using USB cable

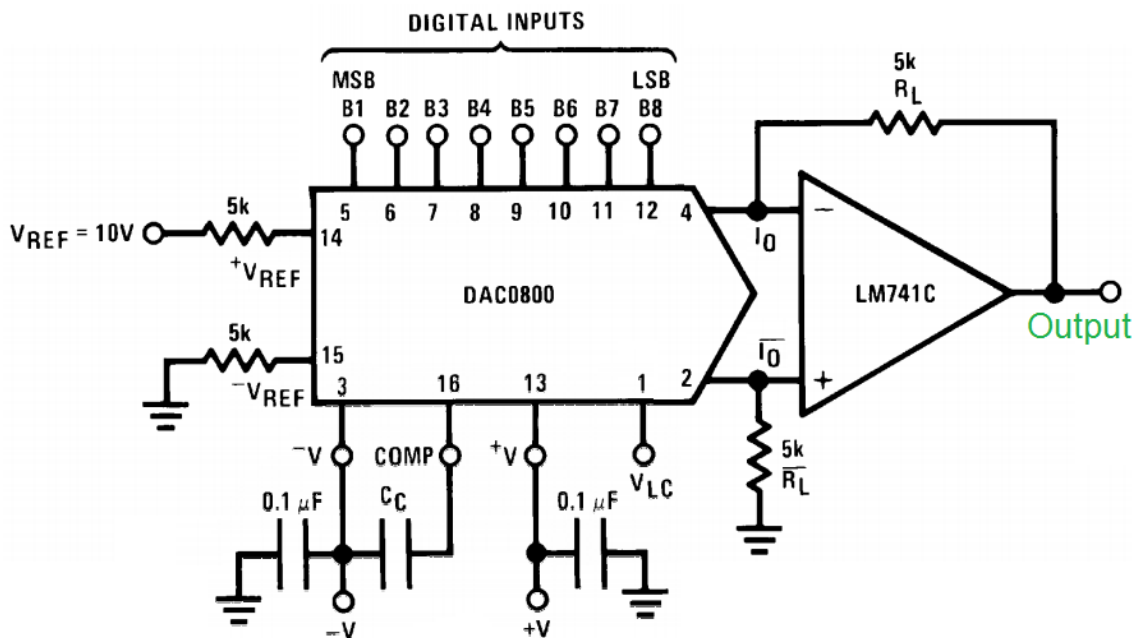


- Program it with relevant code

Step 2

DUT / SOURCE SETUP

- Rig-up the circuit as shown in figure



Step 3

SCOPE SETUP

- Power ON the oscilloscope
- Connect the Channel 1 probe of the oscilloscope to output
- Acquire the signal(s) from circuit on oscilloscope

Step 4

- Do the Autoset on the scope to efficiently capture and view the signal
- If AUTOSSET feature is not enabled, then manually set the horizontal and vertical scale, and trigger condition to view 3-4 cycles of waveform without any clipping.

Step 5

Measurement Configuration

- Add Mean measurements on the Channel
- Read the measured average amplitude for the signal converted by DAC from the digital code generated using Arduino.

Step 6

- Verify the conversion of DAC for different digital codes by measuring their corresponding digital value.