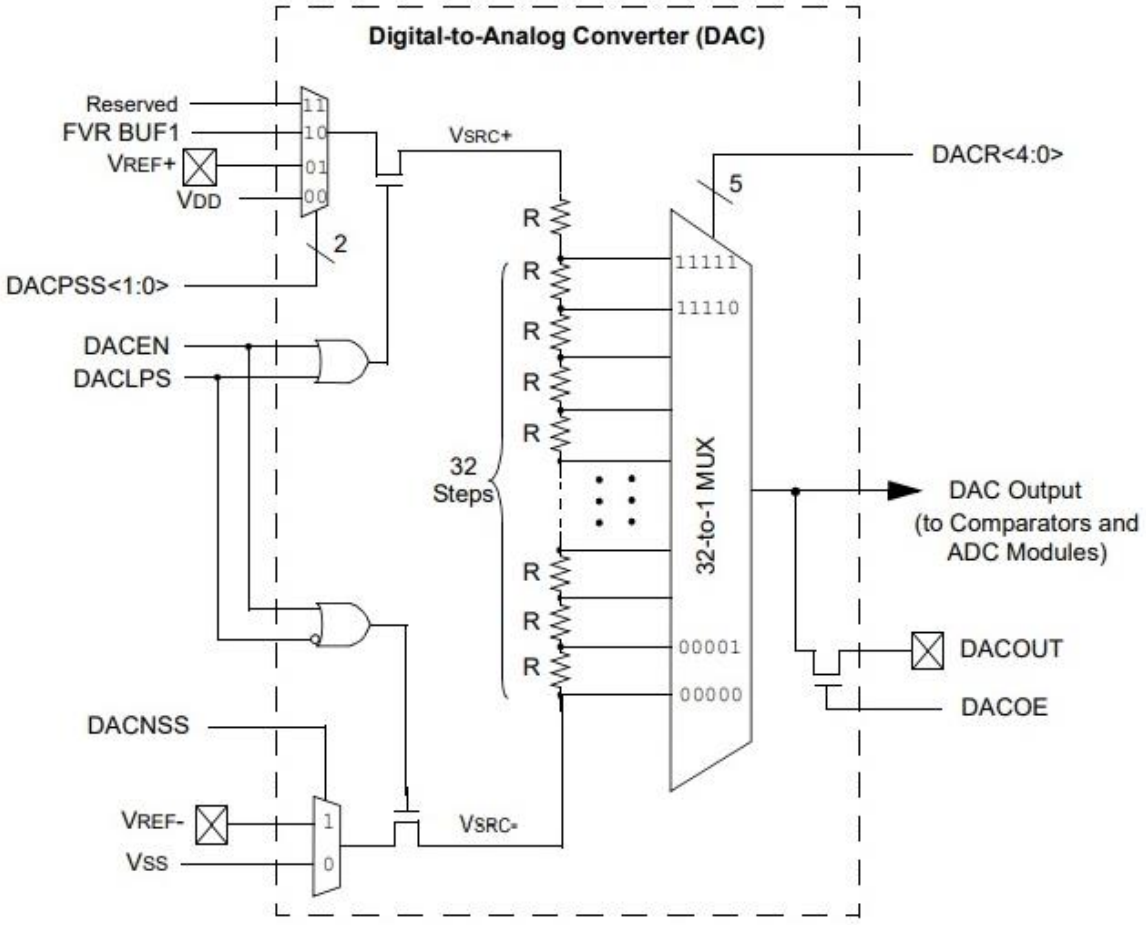
UNIT IV

INTERFACING WITH PIC MICROCONTROLLER

DAC INTERFACING WITH PIC16F877A

Digital and Analog is an integral part of Electronics. Most of the devices have both ADC as well as DAC and they are used when there is a need of converting signals either from analog to digital or digital to analog. Another type of DAC is a Pulse Width Modulator (PWM). A PWM takes a digital word and generates a digital pulse with variable pulse width. When this signal is passed through a filter, the result will be purely analog. An analog signal can have multiple types of data in a signal.



MCP4921 is a 12 bit DAC, so MCP4921 will provide 12 bits of output resolution. DAC resolution means number of digital bits that can be converted into analog signal. How many values we can achieve from this is based on the formula . For 12-bit, it is = 4096. This means 12-bit resolution DAC could produce 4096 different outputs.

By using this value, one can easily calculate the single analog step voltage. For calculating the steps, the reference voltage is required. As the logic voltage for the device is 5V, the step voltage is 5/4095 (4096-1 because the starting point for digital is not 1, it is 0), which is 0.00122100122 millivolt. So, a change of 1 bit will change the analog output with 0.00122100122.

The **MCP4921 IC communicates with the microcontroller by the SPI protocol**. For SPI communication, a device has to be master, which submits data or command to the external device connected as a slave. In SPI communication system, multiple slave devices can be connected with the single Master Device.

To submit the data and the command, it is important to understand the command register.

The **command register is a 16-bit register**. The bit-15 to bit-12 is used for the configuration command. The data input and the configuration is clearly shown in the above image. In this project, the MCP4921 will be used as the following configuration-

Bit Number	Configuration	Configuration Value
Bit 15	DAC_A	0
Bit 14	Unbuffered	0
Bit 13	$1x(V_{OUT}*D/4096)$	1
Bit 12	Output Power Down Control Bit	1

So the Binary is 0011 along with the data which is determined by the D11 to D0 bits of the register. The 16-bit data 0011 xxxx xxxx xxxx need to be submitted where the first 4 bit of MSB is the configuration and the rest is the LSB.