

DS20613 - Assignment 3
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Question-1. Which are the PWM pins and the registers of each PWM pins? How can you change the default frequency of PWM pins?

PWM Pins

PWM Pins used in Arduino Uno Board with Atmega 328P Micro-controller are

Digital I/O pins: 3, 5, 6, 9, 10, 11

Pins 3,9,10,11 uses 490 Hz whereas Pins 5 and 6 uses 980 Hz.

Registers associated with PWM:

Digital I/O PWM pins: 5 and 6 – **Timer 0 Registers** (TCCR0A/B, OCR0A/B)

Digital I/O PWM pins: 9 and 10 – **Timer 1 Registers** (TCCR1A/B/C, OCR1AH/BL, ICR1)

Digital I/O PWM pins: 3 and 11 – **Timer 2 Registers** (TCCR2A/B, OCR2A/B)

Controlling the Frequency of PWM

One can control the frequency of PWM by using different clock source. Once the clock source is fixed, different modes available in ATMEGA328P can be used to fine-tune the frequency of PWM. Setting the Pre-scaler bits (CS02, CS01 and CS00) of TCCRnB to higher or lower pre-scaler values (0,8,64,256,1024) can be used to control the clock source. OCRnA/B register can be used to control the duty cycle.

The following are the five modes of PWM operation which can be switched by assigning the bits (WGMn2:0) associated Timer Register [TCCRnA (WGM01 WGM00) and TCCRnB (WGM02)].

- **Normal Mode** (WGMn2:0 = 0) → **Default mode**
- **Fast PWM Mode** (WGMn2:0 = 3 or 7)
- **Phase Correct PWM Mode** (WGMn2:0 = 1 or 5)
- **Clear Timer on Compare Match (CTC) Mode** (WGMn2:0 = 2)
- **Phase and Frequency Correct PWM Mode** (Timer-1 alone - WGM13:0 = 8 or 9)