Pulse Width Modulation

PWM is able to reduce the average power delivered by an electrical signal by separating it into different parts. The voltage and current being fed into the output is controlled by a switch which switches between supply and output at a fast rate.

It is a way to control analog devices with a digital output. It does this by changing the timing of how long the signal stays HIGH and LOW.

Duty Cycle

An important concept of PWM is the duty cycle. The percentage duty cycle basically means the percentage amount of time that a digital signal stays HIGH over a period of time. If the signal spends half the time being HIGH and half being LOW, it has a duty cycle of 50%. If it spends more time being HIGH, then the duty cycle would be a higher percentage. Figure 1 below shows signals and their respective duty cycles to demonstrate this concept more clearly.
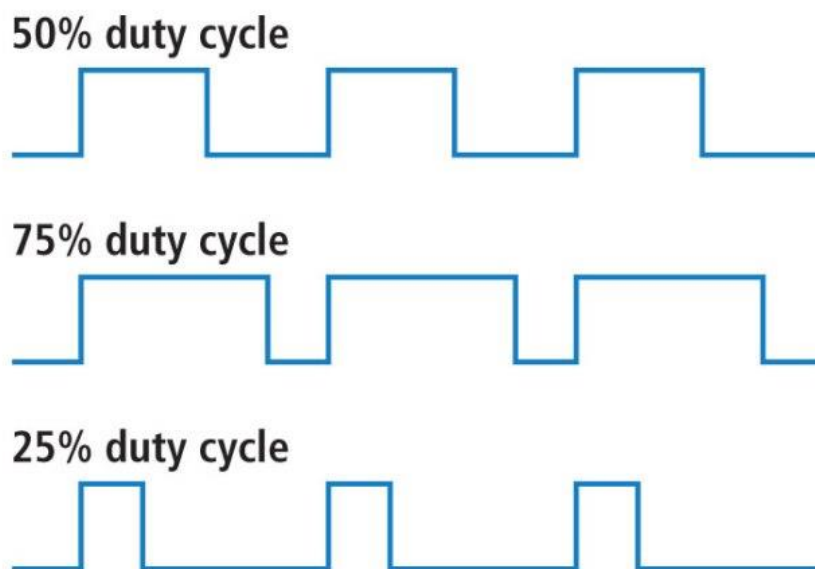

Figure 1

The basic formula to calculate duty cycle is $\frac{ton}{ton+toff} \times 100\%$

There are various things that PWM can be used for, such as controlling brightness of an LED, voltage regulation, amplifying audio signals, etc.