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What is Pulse Width Modulation?

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What is Pulse Width Modulation?

Have you ever wondered how computers dissipate the amount of heat that gets generated by the CPU and other components? Compact electrical fans have been used for better ventilation and for cooling PCs. However, as fans produce noise levels that increase with the rotation speed, different methods were explored to control the speed of the motor and to ultimately quieten it.

In recent years, the technology of controlling the power's output has evolved significantly. Researchers have been looking for methods where a microcontroller or a switch would constantly control the amount of power a motor delivers, as mentioned in the above case, the fan in a PC.

So what is PWM and how does it work? And what are the ways to use the PWM outputs on your intelligent display?

What is PWM?

Pulse Width Modulation (PWM) is a method used for controlling an analogue signal using a digital source. The output voltage of the converter is controlled by modulating the width of the pulse. A lot of power electronic circuits are controlled by PWM signals of various forms.

How does PWM work?

A PWM signal consists of a duty cycle and a frequency. The duty cycle is the amount of time in which the signal is active or is in a 'high' or 'on' state. The duty cycle is expressed as a percentage or ratio of the total time it takes to complete one cycle. The frequency is calculated by finding out how fast the PWM completes a duty cycle. In other words, it means the frequency is determined how fast it switches between high and low states. By steering a digital signal off and on at a fast rate and at a particular duty cycle, the output will perform like a constant voltage analogue signal when providing power to devices.

The energy is distributed through a series of pulses rather than a continuously varying signal. By increasing or decreasing pulse width, i.e. how long the digital signal is held high, the energy flow to the motor shaft can be controlled.

PWM is found in a wide variety of applications, ranging from control circuitry to telecommunications to servomechanisms to power delivery and as an efficient voltage regulator.

Let's take a look at the ways to use the PWM outputs on your intelligent display.

Dimming the LED backlight

One of the most popular applications of PWM is controlling the brightness of LED and LCD displays. The majority of LCD displays contain a LED backlight. LED lighting is used due to its efficiency, life span, and energy saving properties. Because the brightness and colour of an LED can affect the display, the LED lighting system requires an application to adjust the brightness and colour at the same time. PWM can be used to control the brightness level of the LED by turning the LED on and off at a specific rate. The naked eye cannot see these rapid oscillations of light, so even when the light is off we see the light as on.

Controlling the brightness of the display in laptops

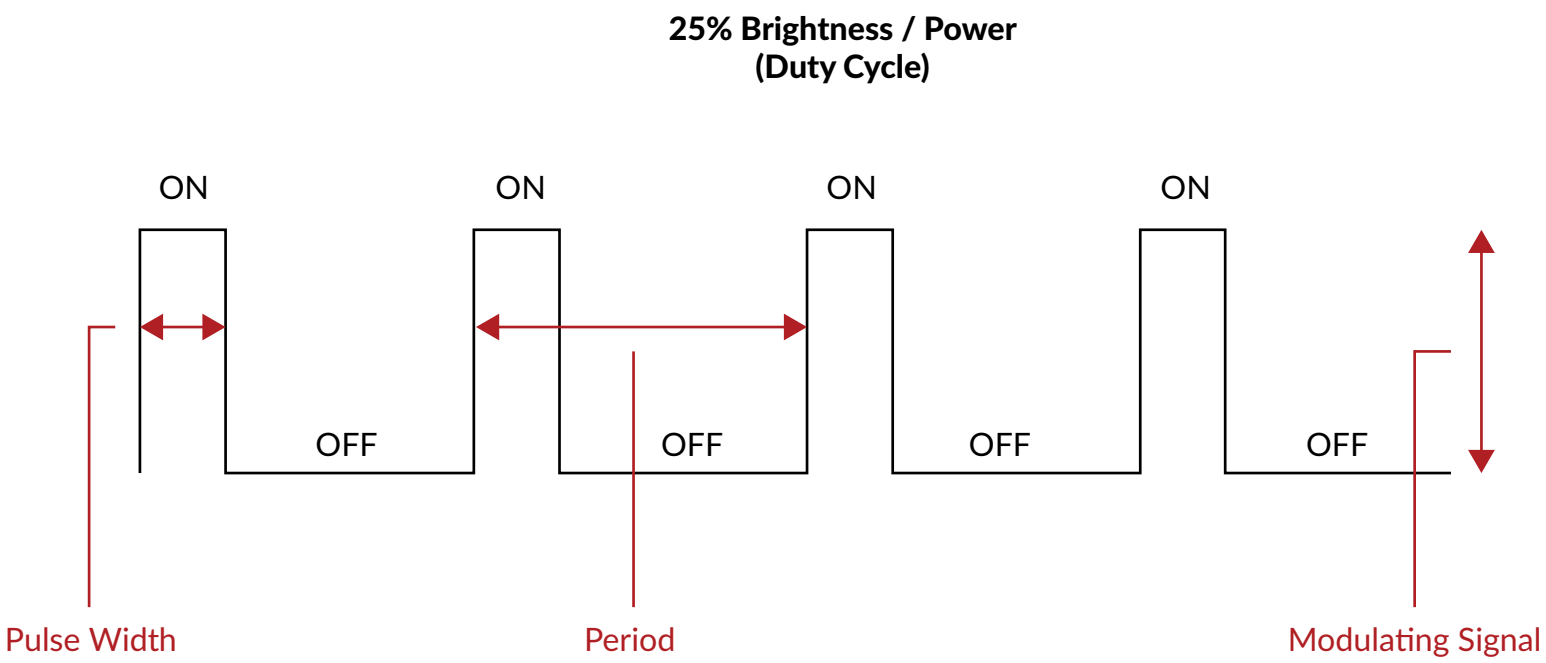
Following the same principle, PWM is also used to regulate the brightness of the display in laptop monitors. When a monitor is set to maximum brightness the LEDs are glowing at full strength. If you reduce the brightness to 50%, the light intensity is lowered by inserting small pauses where the LEDs turn on and off for a very short time. When you reduce the brightness setting further, the pauses become longer, reducing the brightness further.

Controlling the speed of a fan (DC motor) in the CPU

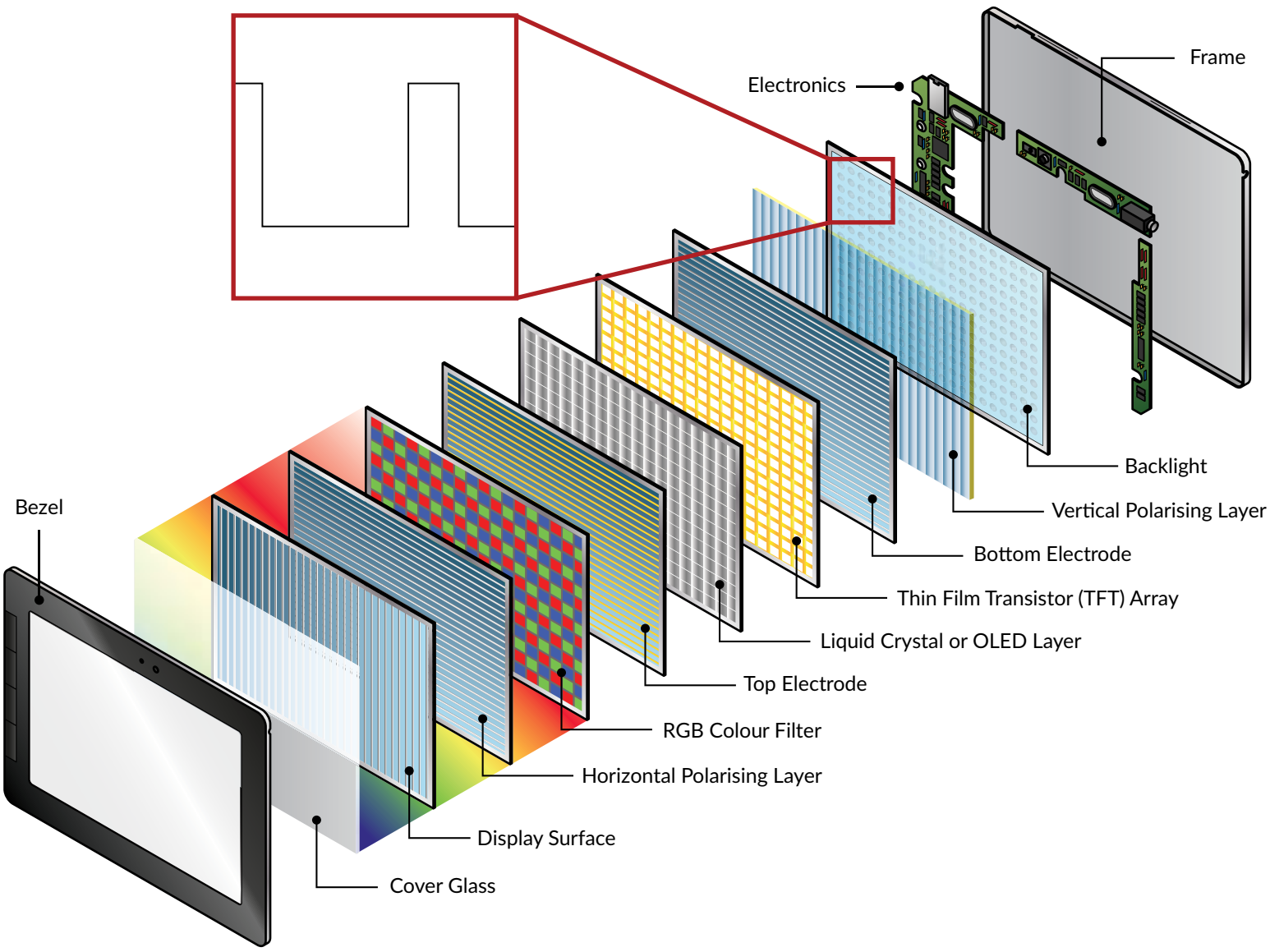
As mentioned in the introduction, PWM can also be used to control the speed of a motor by regulating the amount of power delivered. PWM speed control works by driving the motor with a series of on and off pulses and varying the duty cycle of the pulses while keeping the frequency constant. It operates like a switch that constantly cycles on and off, thereby regulating the speed of the fan.

Varying the width of these pulses can control the power applied to the motor and thereby varying the average DC voltage applied to the motor's terminals. By modulating the timing of the pulses, the speed of the motor can be controlled. So longer the pulse is on, the faster the motor will rotate and the shorter the pulse is on, the slower the motor will rotate. PWM operates like a switch that constantly cycles on and off, thereby regulating the speed of the fan.

PWM has emerged as a solution for a wide variety of applications.



The screen's brightness is adjusted using PWM (Pulse Width Modulation)



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