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Hybrid Dimming Control for both PWM and AUX

Abstract: Both PWM and AUX dimming control techniques are implemented in a single firmware set for an eDP (embedded display port) LCD panel to allow the panel to work with graphics vendors using either dimming technique.

This disclosure relates to the field of LCD display panels.

A technique is disclosed that incorporates both PWM and AUX dimming control in an eDP (embedded display port) LCD panel.

Different methods of dimming control are used by different graphics vendors. A first method utilizes a pulse-width modulated (PWM) analog signal. The graphics outputs the PWM signal and controls the brightness by changing the duty cycle ratio of the signal. A second method utilizes a pure digital signal. After link training by AUX channel communication, the graphics enables timing controller (TCON) support for AUX dimming. The graphics writes a brightness value via the AUX channel in the TCON DPCD 00722 and 00723 registers. TCON then reads the DPCD registers and then controls the PWM IC and the LED driver IC.

Up to now, in notebook LCD panels PWM and AUX dimming control are separate and independent. If the LCD panel supports AUX dimming control but would instead like to support platforms that use PWM dimming, the LCD vendor has to modify the TCON firmware to disable AUX dimming via the TCON or modify the BIOS to set dimming control via PWM only. If the LCD panel supports PWM dimming control but would instead like to be usable on platform that use AUX dimming, the LCD vendor has to modify the TCON firmware to enable AUX dimming via the TCON. This involves BIOS and/or GFX driver modifications.

According to the present disclosure, both PWM and AUX dimming control methods are implemented in one firmware set for the TCON of an LCD panel. This hybrid dimming control method is implemented in the following manner.

First, the LCD Panel PC board layout retains the PWM input and output circuits.

The TCON DPCD register setting enables both PWM & AUX dimming support for link training communication. This is done by (a) changing the settings of the DPCD 00701 & 00702 registers from PWM dimming control only, to AUX dimming capable; and (b) setting the DPCD 00703 register to align TCON and nVIDIA AUX dimming register read/write sequence as LSB to MSB in DPCD 00723 (LSB) & 00723 (MSB). The TCON IC firmware is then set to enable AUX dimming input and output.

The disclosed technique advantageously provides a single TCON firmware set that allows an LCD panel to support both PWM and AUX dimming across different platforms without requiring any BIOS or GFX driver modifications. This reduces complexity and avoids dimming control malfunction that have occurred after a BIOS update that changes the default dimming settings.

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