非晶矽薄膜電晶體開電流光敏感度用於背光感測之研究

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摘 要

近年來液晶顯示器（AMLCD）的發展重心，已從早期的薄膜電晶體陣列設計逐漸轉移到背光模組的發展。目前市面上液晶螢幕所使用的背光種類，常見的包括有冷陰極螢光燈管（CCFL）以及發光二極體（LED）。比較其優缺點，發光二極體不僅在色飽和度上優於冷陰極螢光燈管。從環境保護得觀點，由於發光二極體不需使用汞原料，因此發光二極體已有逐漸取代冷陰極螢光燈管之趨勢。而目前局部暗淡（local dimming）是發光二極體背光模組最受矚目的特有功能，其目的在於加強畫面的對比度，亦可減少顯示器的耗電量。

在本篇論文中，我們針對發光二極體背光模組的特性來做探討。在有局部暗淡功能的背光模組，其背光強度並非固定，而會隨著顯示的畫面做調整。因此我們提出藉由背光感測器來偵測背光強度的想法，進而可以確定背光的強度是否達到理想的情況。並且我們提出一種利用相同於非晶矽薄膜電晶體製成的感測電路，故可在不變動製成步驟和不增加成本的情況下達到面板與感測電路整合的目的。其中我們所使用的感光元件為非傳統型結構的非晶矽薄膜電晶體，並且針對在 LED 背光照射下的光特性做仔細的研究。同時，我們也分析可能會在元件感光上造成誤差的因素，並提出降低感測誤差的方法。

Study on ON Current Photosensitivity of a-Si TFTs for Backlight Sensing

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Abstract

In recent years, the development focus of AMLCD shifts gradually from TFT array design to the backlight module. The most common backlight modules in LCDs include CCFL and LED. Comparison between them, LED has better color gamut and no mercury using. We find that LED has the tendency to substitute CCFL. At present, the local dimming function of LED backlight is the most paid attention. The function is for enhancing the image contrast and saving the LCD power consumption.

In this thesis, we discuss on the basis of the characteristic of LED backlight. The backlight intensity with local dimming function is not constant, and it is self-adjusting according to the frame would be shown. Therefore, we have an idea about using backlight sensors to detect the backlight intensity, and then it can be verified whether or not the backlight achieves the right intensity. The proposed light sensing circuit has the same a-Si TFTs fabrication process. Thus, the light sensing circuit can be integrated in panel without changing the mask number and extra cost. The sensing device we used is non-conventional structure of a-Si TFT, and we present a detailed experimental study of the sensing device behavior under LED backlight illumination. Moreover, we analyze the possible factors to cause light sensing error, and propose some feasible methods to calibrate and reduce sensing error.

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