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作品名稱
可內嵌於低溫多晶矽面板的射頻辨識標籤
An LTPS-TFT RFID Tag Embeddable on Panel Display

隊伍名稱
amtg-one

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作品摘要

自從1930年代美國軍方開發無線射頻辨識(Radio Frequency Identification, RFID)系統以來,由於有著低成本、商品資訊易電子化及應用場合多樣化等優勢,使得這項技術在近年來越來越受到矚目。隨著市場需求越來越大,使得無線射頻辨識系統有著爆炸性發展。

在面板製程越來越進步之時代,低溫多晶矽(Low Temperature Polycrystalline Silicon, LTPS)面板較之傳統非晶矽型有著許多的優勢,除了高開口率(Aperture Ratio)、元件縮小化、高解析度等優點之外,其中一個最大的優勢即是低溫多晶矽製程中的薄膜電晶體(Thin Film Transistor, TFT)有著較高的電子遷移率(Mobility),傳統非晶矽薄膜電晶體的電子遷移率大約為1 cm^2/V-s左右,在低溫多晶矽薄膜電晶體的電子遷移率可以達到100 cm^2/V-s,甚至在某些實驗型薄膜電晶體上可以高達幾百以上的電子遷移率。這項優勢有相當的訊號驅動與系統整合能力,這樣對於系統化面板(System on Panel, SoP)更有實現與達成的機會。

無線射頻辨識標籤在量產上最大面臨的一個挑戰,即是低成本化的普及。在一般目前所用的無線射頻標籤多是使用CMOS製程,在應用於倉儲管理或身分辨識系統的情況下通常都搭配面板顯示一起使用。因此,我們希望無線射頻辨識標籤的電路系統依附在面板製程中一併製造,使得我們可以直接利用像是手機的小尺寸面板直接加上本作品所開發的無線射頻辨識標籤的電路系統。在不使用CMOS製程下,透過低溫多晶矽(Low Temperature Polycrystalline Silicon, LTPS)面板製程讓我們的面板就有無線射頻辨識標籤的電路系統,不僅節省製程成本,也可以達到面板系統化的整合。預期可以使得大量貨品的倉儲管理或人員身分辨識系統等有關於無線射頻辨識標籤的應用,可以大幅節省成本並且更大量的普及應用。

指導教授

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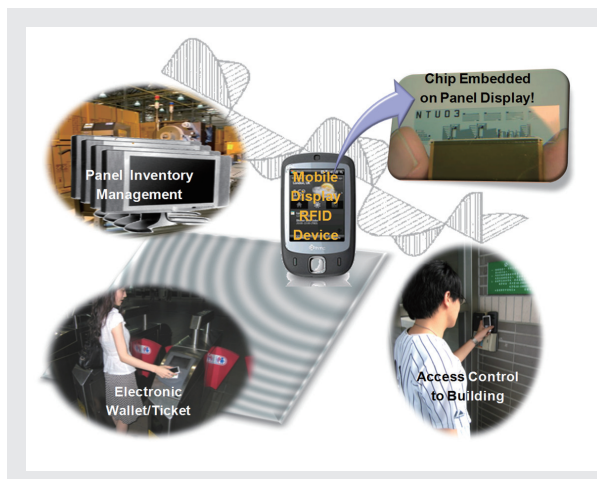
Abstract

Radio frequency identification (RFID) has been used for military aircraft identification since late 1930s. The applications of RFID technique have proliferated in the last ten years. The data exchanging and computing become extensive and ubiquitous. One of the important RFID applications is inventory and supply chain management. The automatic identification relies on storing and remotely retrieving data using RF tags or transponders. Although the function blocks of RFID tags are not complex, making their cost negligible is a challenge.

One of the major ascendants of RFID is its excellent adaptability with many kinds of industries. Thanks to the characteristics of low-temperature polycrystalline silicon (LTPS) thin-film transistor (TFT), RFID may tie closely with panel displays. Although the current mainstream technology to manufacture active matrix liquid crystal displays (AMLCD) is amorphous silicon (α-Si) TFT, the high electron mobility of polycrystalline silicon (poly-Si) TFT results in better display brightness and resolution. In addition, the speed of LTPS TFT is fast enough for developing integrated circuits on glass and flexible organic substrate to realize system on panel (SoP). Embedding RFID tags on panel displays using LTPS TFT raises the added values of displays and enhances the levels of integration at almost no additional cost.

The application of the RFID embedded on panel displays is very powerful in inventory tracking and supply chain control. Since panel displays have been widely used in many electronic devices, such as TV, monitors, and many portable devices, the manufacture and logistics management using panel display embedded RFID will not be limited to only panel displays and can be extended to the electronic devices with panel displays. The LTPS TFT RFID technology creates the new vision which encompasses many possibility of mobile near field communication (NFC) Many portable electronic devices such as smart phones and audio/video players are being carried around in modern daily life. Therefore, the RFID tags embedded on the panel displays of the portable devices can enable a variety of mobile NFC applications.

Chip Embedded on Panel Display!

NTUD3-

Panel Inventory Management

Mobile Display RFID Device

Electronic Wallet/Ticket

Access Control to Building

As shown in Fig. 1, the smart phone with an embedded LTPS TFT RFID tag turns into a mobile NFC device. It can be used for electronic ticketing and building access control. Moreover, the mobile NFC device can be further extended to include the function of electronic wallet to manage daily expense.