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Schlegel

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(54) **TRANSISTOR BACKPLANES FOR LIQUID CRYSTAL DISPLAYS COMPRISING DIFFERENT SIZED SUBPIXELS**

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(51) **Int. Cl.**
G09G 3/36 (2006.01)

(52) **U.S. Cl.** **345/88**; 345/92; 345/695

(58) **Field of Classification Search** 345/72, 345/83, 88–103, 690, 695; 315/169.3; 349/42, 349/142, 143
See application file for complete search history.

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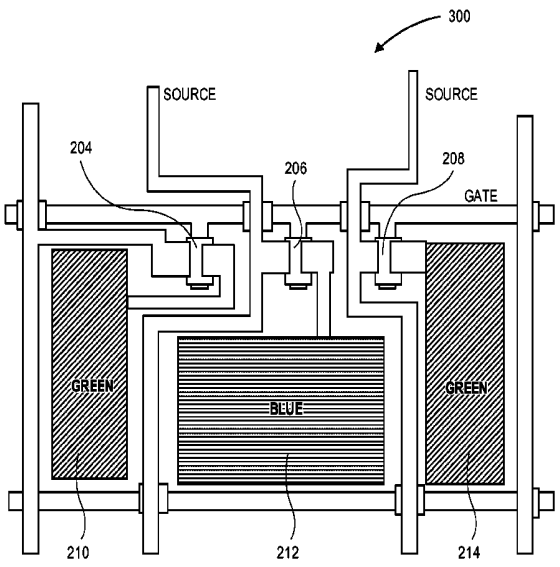
(57) **ABSTRACT**

A display and a method for manufacturing said display is disclosed wherein said display is comprised of at least a first set of subpixels and a second set of subpixels—said first set of subpixels comprising smaller area than said second subpixels. The thin film transistors that drive said first set of subpixels are formed substantially in the area of said second set of subpixels.

7 Claims, 3 Drawing Sheets



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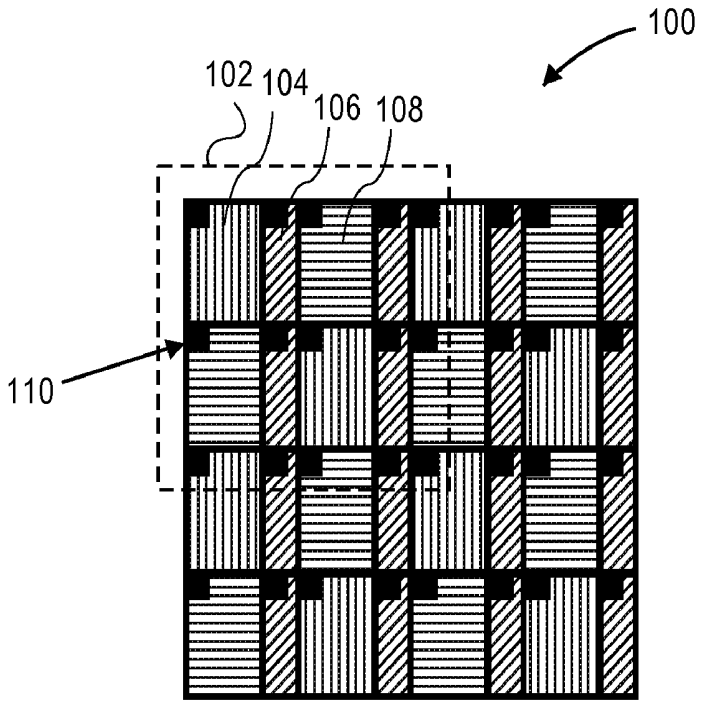

FIG. 1

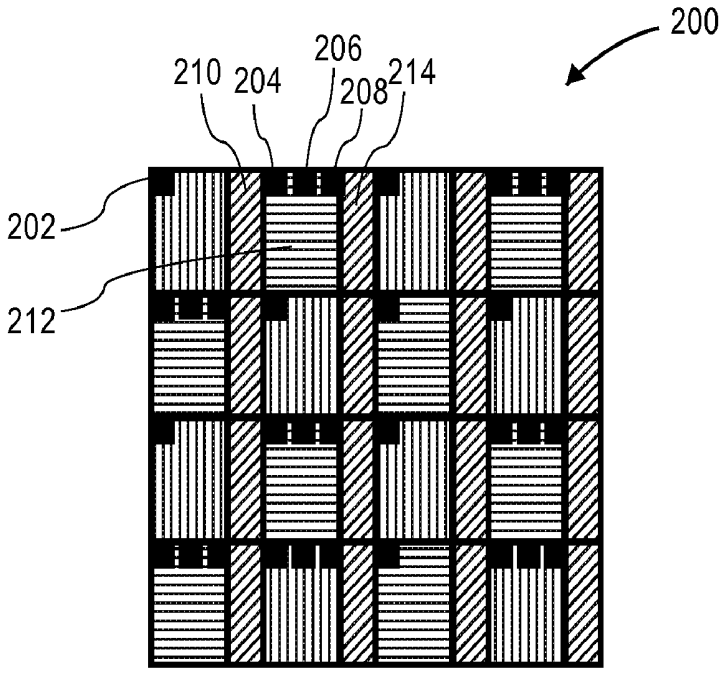

FIG. 2

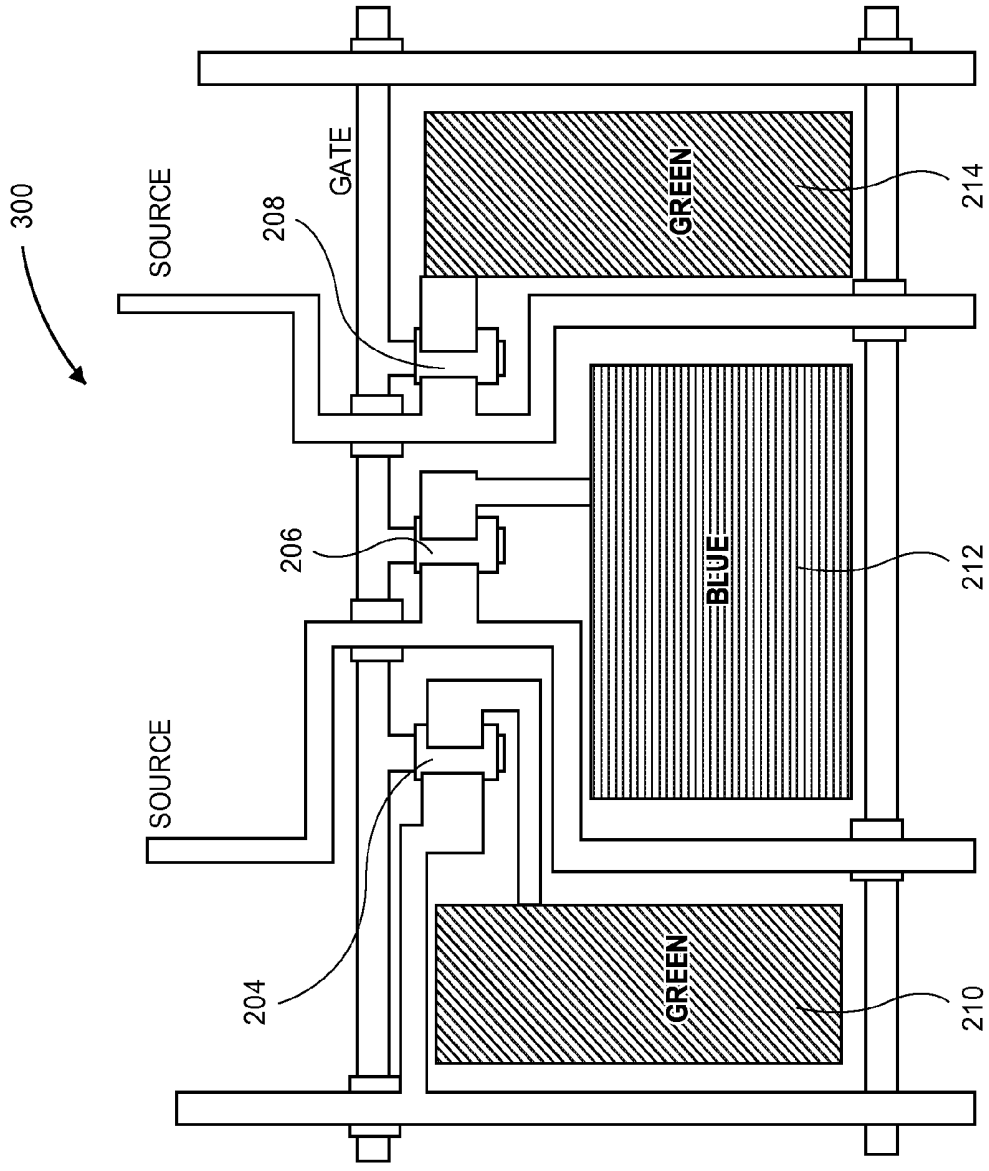
300
SOURCE
GATE
208
GREEN
214
206
BLUE
212
SOURCE
204
GREEN
210

FIG. 3

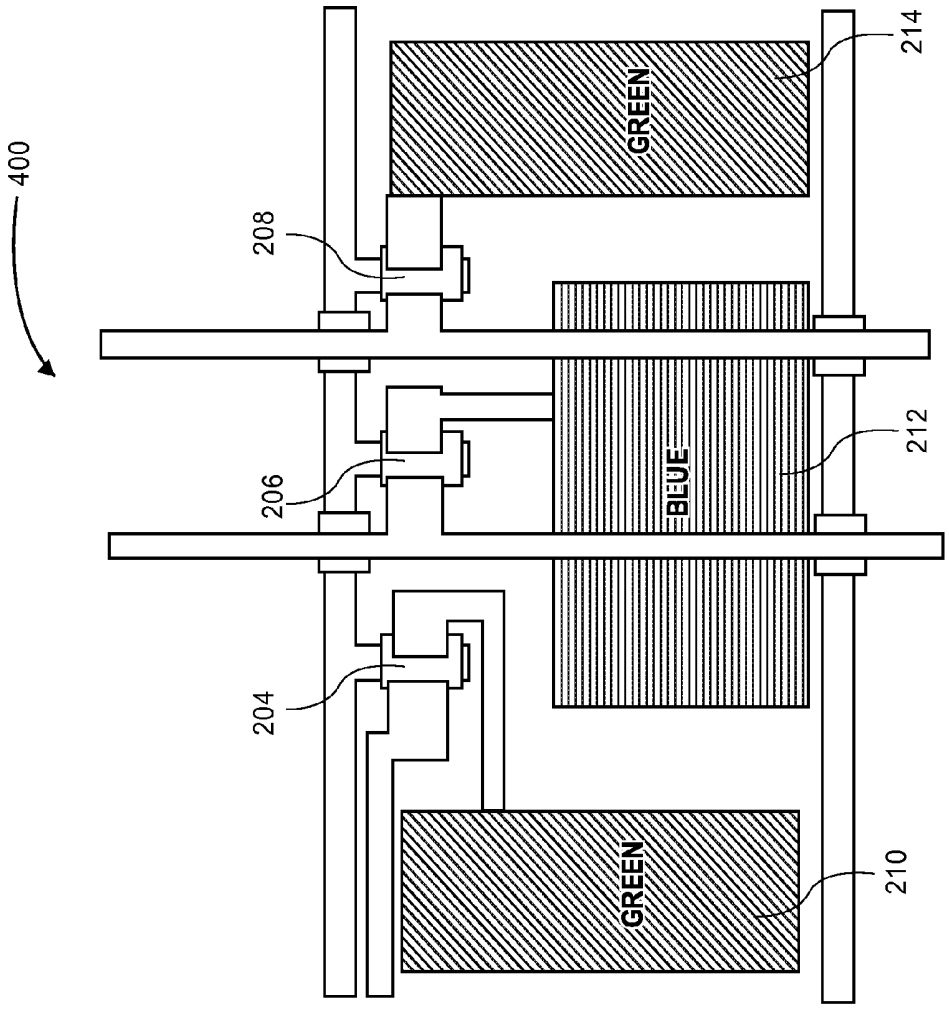

FIG. 4

TRANSISTOR BACKPLANES FOR LIQUID CRYSTAL DISPLAYS COMPRISING DIFFERENT SIZED SUBPIXELS

BACKGROUND

In commonly owned United States patent applications: (1) U.S. patent application Ser. No. 09/916,232 ("the '232 application"), entitled "ARRANGEMENT OF COLOR PIXELS FOR FULL COLOR IMAGING DEVICES WITH SIMPLIFIED ADDRESSING," filed Jul. 25, 2001, now issued as U.S. Pat No. 6,903,754; (2) U.S. patent application Ser. No. 10/278,353 ("the '353 application"), entitled "IMPROVEMENTS TO COLOR FLAT PANEL DISPLAY SUB-PIXEL ARRANGEMENTS AND LAYOUTS FOR SUB-PIXEL RENDERING WITH INCREASED MODULATION TRANSFER FUNCTION RESPONSE," filed Oct. 22, 2002, and published as U.S. patent application Publication No. 2003/0128225; (3) U.S. patent application Ser. No. 10/278,352 ("the '352 application"), entitled "IMPROVEMENTS TO COLOR FLAT PANEL DISPLAY SUB-PIXEL ARRANGEMENTS AND LAYOUTS FOR SUB-PIXEL RENDERING WITH SPLIT BLUE SUB-PIXELS," filed Oct. 22, 2002, and published as U.S. patent application Publication No. 2003/0128179; (4) U.S. patent application Ser. No. 10/243,094 ("the '094 application), entitled "IMPROVED FOUR COLOR ARRANGEMENTS AND EMITTERS FOR SUB-PIXEL RENDERING," filed Sep. 13, 2002, and published as U.S. patent application Publication No. 2004/0051724; (5) U.S. patent application Ser. No. 10/278,328 ("the '328 application"), entitled "IMPROVEMENTS TO COLOR FLAT PANEL DISPLAY SUB-PIXEL ARRANGEMENTS AND LAYOUTS WITH REDUCED BLUE LUMINANCE WELL VISIBILITY," filed Oct. 22, 2002, and published as U.S. patent application Publication No. 2003/0117423; (6) U.S. patent application Ser. No. 10/278,393 ("the '393 application"), entitled "COLOR DISPLAY HAVING HORIZONTAL SUB-PIXEL ARRANGEMENTS AND LAYOUTS," filed Oct. 22, 2002, and published as U.S. patent application Publication No. 2003/0090581; and (7) U.S. patent application Ser. No. 01/347,001 ("the '001 application") entitled "IMPROVED SUB-PIXEL ARRANGEMENTS FOR STRIPED DISPLAYS AND METHODS AND SYSTEMS FOR SUB-PIXEL RENDERING SAME," filed Jan. 16, 2003, and published as U.S. patent application Publication No. 2004/0080479, each of which is herein incorporated by reference in its entirety, novel sub-pixel arrangements are disclosed for improving the cost/performance curves for image display devices.

For certain subpixel repeating groups having an even number of subpixels in a horizontal direction, the following systems and techniques to affect proper dot inversion schemes are disclosed and these applications are herein incorporated by reference in their entirety: (1) U.S. patent application Ser. No. 10/456,839 entitled "IMAGE DEGRADATION CORRECTION IN NOVEL LIQUID CRYSTAL DISPLAYS", and published as U.S. patent application Publication No. 2004/0246280; (2) U.S. patent application Ser. No. 10/455,925 entitled "DISPLAY PANEL HAVING CROSSOVER CONNECTIONS EFFECTING DOT INVERSION", and published as U.S. patent application Publication No. 2004/0246213; (3) U.S. patent application Ser. No. 10/455,931 entitled "SYSTEM AND METHOD OF PERFORMING DOT INVERSION WITH STANDARD DRIVERS AND BACKPLANE ON NOVEL DISPLAY PANEL LAYOUTS", and issued as U.S. Pat. No. 7,218,301; (4) U.S. patent application Ser. No. 10/455,927 entitled "SYSTEM AND METHOD FOR COMPENSATING FOR VISUAL EFFECTS UPON PANELS HAVING FIXED PATTERN NOISE WITH REDUCED QUANTIZATION ERROR", and issued as U.S. Pat. No. 7,209,105; (5) U.S. patent application Ser. No. 10/456,806 entitled "DOT INVERSION ON NOVEL DISPLAY PANEL LAYOUTS WITH EXTRA DRIVERS", and issued as U.S. Pat. No. 7,187,353; (6) U.S. patent application Ser. No. 10/456,838 entitled "LIQUID CRYSTAL DISPLAY BACKPLANE LAYOUTS AND ADDRESSING FOR NON-STANDARD SUBPIXEL ARRANGEMENTS", and published as U.S. patent application Publication No. 2004/0246404; and (7) U.S. patent application Ser. No. 10/696,236 entitled "IMAGE DEGRADATION CORRECTION IN NOVEL LIQUID CRYSTAL DISPLAYS WITH SPLIT BLUE SUB-PIXELS", filed Oct. 28, 2003, and published as U.S. patent application Publication No. 2005/0083277.

These improvements are particularly pronounced when coupled with sub-pixel rendering (SPR) systems and methods further disclosed in those applications and in commonly owned United States patent applications and patents: (1) U.S. patent application Ser. No. 10/051,612 ("the '612 application"), entitled "CONVERSION OF A SUB PIXEL FORMAT DATA TO ANOTHER MATRIX SUB-PIXEL DATA FORMAT," filed Jan. 16, 2002, and now issued as U.S. Pat. No. 7,123,277; (2) U.S. patent application Ser. No. 10/150,355 ("the '355 application"), entitled "METHODS AND SYSTEMS FOR SUB-PIXEL RENDERING WITH GAMMA ADJUSTMENT," filed May 17, 2002, and now issued as U.S. Pat. No. 7,221,381; (3) U.S. patent application Ser. No. 10/215,843 ("the '843 application"), entitled "METHODS AND SYSTEMS FOR SUB-PIXEL RENDERING WITH ADAPTIVE FILTERING," filed Aug. 8, 2002, and now issued as U.S. Pat. No. 7,184,066; (4) U.S. patent application Ser. No. 10/379,767 entitled "SYSTEMS AND METHODS FOR TEMPORAL SUB-PIXEL RENDERING OF IMAGE DATA" filed Mar. 4, 2003, and published as U.S. patent application Publication No. 2004/0196302; (5) U.S. patent application Ser. No. 10/379,765 entitled "SYSTEMS AND METHODS FOR MOTION ADAPTIVE FILTERING," filed Mar. 4, 2003, and now issued as U.S. Pat. No. 7,167,186; (6) U.S. patent application Ser. No. 10/379,766 entitled "SUB-PIXEL RENDERING SYSTEM AND METHOD FOR IMPROVED DISPLAY VIEWING ANGLES" filed Mar. 4, 2003, and now issued as U.S. Pat. No. 6,917,368; and (7) U.S. patent application Ser. No. 10/409,413 entitled "IMAGE DATA SET WITH EMBEDDED PRE-SUBPIXEL RENDERED IMAGE" filed Apr. 7, 2003, and published as U.S. patent application Publication No. 2004/0196297, which are hereby incorporated herein by reference in their entirety.

Improvements in gamut conversion and mapping are disclosed in commonly owned and co-pending United States patent applications: (1) U.S. patent application Ser. No. 10/691,200 entitled "HUE ANGLE CALCULATION SYSTEM AND METHODS", filed Oct. 21, 2003, and now issued as U.S. Pat. No. 6,980,219; (2) U.S. patent application Ser. No. 10/691,377 entitled "METHOD AND APPARATUS FOR CONVERTING FROM SOURCE COLOR SPACE TO RGBW TARGET COLOR SPACE", filed Oct. 21, 2003, and published as U.S. patent application Publication No. 2005/0083341; (3) U.S. patent application Ser. No. 10/691,396 entitled "METHOD AND APPARATUS FOR CONVERTING FROM A SOURCE COLOR SPACE TO A TARGET COLOR SPACE", filed Oct. 21, 2003, and published as U.S. patent application Publication No. 2005/0083352; and (4) U.S. patent application Ser. No. 10/690,

716 entitled "GAMUT CONVERSION SYSTEM AND METHODS", and now issued as U.S. Pat. No. 7,176,935, which are all hereby incorporated herein by reference in their entirety.

Additional advantages have been described in (1) U.S. patent application Ser. No. 10/696,235 entitled "DISPLAY SYSTEM HAVING IMPROVED MULTIPLE MODES FOR DISPLAYING IMAGE DATA FROM MULTIPLE INPUT SOURCE FORMATS", filed Oct. 28, 2003, and now issued as U.S. Pat. No. 7,084,923; and (2) U.S. patent application Ser. No. 10/696,026 entitled "SYSTEM AND METHOD FOR PERFORMING IMAGE RECONSTRUCTION AND SUBPIXEL RENDERING TO EFFECT SCALING FOR MULTI-MODE DISPLAY" filed Oct. 28, 2003, and published as U.S. patent application Publication No. 2005/0088385; which are all hereby incorporated by reference. All patent applications mentioned in this specification are hereby incorporated by reference in their entirety.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in, and constitute a part of this specification illustrate exemplary implementations and embodiments of the invention and, together with the description, serve to explain principles of the invention.

FIG. **1** is an example of a display comprising a subpixel repeating unit wherein there are at least two subpixels comprising different sizes and/or dimensions and an associated TFT backplane.

FIG. **2** is one example of a display comprising at least two subpixels having different sizes/dimensions with a TFT backplane as made in accordance with the principles of the present invention.

FIG. **3** is one example of an implementation of a TFT backplane as made in accordance with the principles of the present invention.

FIG. **4** is another example of an implementation of a TFT backplane as made in accordance with the principles of the present invention.

DETAILED DESCRIPTION

Reference will now be made in detail to implementations and embodiments, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

In commonly-owned applications listed above, there are shown display panels comprising a subpixel repeating group that further comprises subpixels of different physical dimensions. One example is shown in FIG. **1**. A portion of display panel **100** is depicted here as comprising an octal repeating subpixel grouping **102** that comprises a checkerboard of red subpixels **104** and blue subpixels **108**. These red and blue subpixels are larger in width that the four interspersed green subpixels **104**. Each subpixel is shown as being driven by a thin film transistor (TFT) **110** in one of the corners of the subpixel.

It may not be desirable to locate these TFTs in the corner of the smaller subpixels for several reasons. First, as the smaller subpixels are impacted in their aperture ratio more greatly than the larger subpixels, it might be desirable to locate their TFTs elsewhere. Second, at sufficiently high dots per inch (DPI), defects in the manufacture of TFTs for smaller sized subpixels might adversely impact the overall yield of panels having different sized subpixels. This may be especially true for amorphous silicon (a-Si) displays having pixel densities at or above approximately 150 dpi. This may be adversely impact aperture ratio because of the relatively large TFT used in a-Si.

Additionally, there may be some defects that arise in mask misalignments that result in the smaller (in this example, green) subpixels being more impacted over most of the panel than the larger (e.g, red and blue) subpixels. Such misalignments may create a color shift overall and could be corrected by tuning the backlight for such defective panels or by designing the manufacturing process to create up to a certain level of mask misalignment. However, moving the TFTs into the larger subpixels might alleviate to some degree the overall color shifting that might occur with mask misalignments.

It should be appreciated that the principles of the present invention are applicable to any subpixel layout having subpixels of different size. In fact, the number of subpixels in the repeating group and their color assignments may be any desired and chosen. It suffices that there are merely at least two subpixels that have different sizes/dimensional for the purpose of the present invention. Additionally, it might be desirable to locate all smaller subpixel TFTs into larger subpixel areas; or it may be desirable to locate a subset of such smaller subpixel TFTs into larger subpixel areas. It suffices that some of such smaller subpixel TFT are formed and located into larger subpixel areas. Thus, the scope of the present invention should not be limited to the particular examples of such layouts disclosed in the drawings and the specification.

FIG. **2** depicts one embodiment of an improved TFT layout for displays comprising subpixels of different sizes. In this embodiment, the transistors in the smaller sized subpixels are moved to reside in the area of the larger subpixels. For example, in FIG. **2**, it is seen that TFT **202** drives a red subpixel and blue subpixel **212** comprises TFTs **204**, **206** and **208**—which might drive subpixels **210**, **212** and **214**. In this embodiment, the aperture ratio of the blue subpixels would be impacted more than either the smaller, green subpixels or the larger red subpixel. This arrangement might be desirable, as the color blue has less emphasis in the human visual system.

Of course, it would be appreciated that other embodiments would also be suitable. For example, the red subpixels could contain all or one extra TFTs to help drive the smaller subpixels. Additionally, the plurality of TFTs placed inside the larger subpixel may be placed in different locations (e.g. lower side or different corners) of the subpixel.

Additionally, other color assignments for the larger and the smaller subpixels could be arranged. As stated above, it merely suffices that there are at least two different sized subpixels of any color and that some or all of the TFTs that would drive the smaller subpixels are constructed in the areas of the larger subpixels.

FIGS. **3** and **4** show two possible embodiments for implementations of TFTs that drive proximate smaller subpixels within a larger subpixel—such as for subpixel **212** in FIG. **2**. As may be seen, subpixels **210** and **214** are driven by TFTs **204** and **208** that are located with the space allocated to subpixel **212** in both FIGS. **3** and **4**. It should be appreciated that neither FIG. **3** or **4** are drawn to scale here. Additionally, it should be appreciated that there are many other possible TFT designs that would suffice for the purposes of the present invention.

While the invention has been described with reference to an exemplary embodiment, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the appended claims.

What is claimed is:

1. A display comprising:

a plurality of first subpixels;

a plurality of second subpixels, wherein said first subpixels have a smaller size than said second subpixels; and

a plurality of transistors driving said first and said second subpixels wherein said transistors for said first subpixels are formed in the area of said second subpixels.

2. The display of claim **1** wherein said plurality of first subpixels comprise a first color filter and said plurality of second subpixels comprise a second color filter and a third color filter.

3. The display of claim **2** wherein said second color filter is blue and said plurality of transistors driving said plurality of said first subpixels are formed in said blue color filtered subpixels.

4. A method for manufacturing in a LCD display wherein said LCD display comprises at least a first set of subpixels and a second set of subpixels wherein said first set of subpixels comprise a smaller area than said second set of subpixels and further wherein said first and said second subpixels are driven by a set of thin film transistors; the steps of said method comprising:

forming a thin film transistor backplane such that a plurality of thin film transistors driving a subset of said first set of subpixels are formed substantially in the area of said second set of subpixels.

5. The method of claim **4** wherein said first set of subpixels comprises green subpixels.

6. The method of claim **4** wherein said first set of subpixels comprises blue subpixels.

7. The method of claim **4** wherein said thin film transistors are formed in a subset of said second set of subpixels, said subset of said second set of subpixels comprising substantially blue subpixels.

* * * * *

专利名称(译)	用于液晶显示器的晶体管背板包括不同尺寸的子像素		
公开(公告)号	US7268758	公开(公告)日	2007-09-11
申请号	US10/807604	申请日	2004-03-23
[标]申请(专利权)人(译)	克雷沃耶提公司		
申请(专利权)人(译)	Clairvoyante公司，INC.		
当前申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
[标]发明人	SCHLEGEL MATTHEW OSBOURNE		
发明人	SCHLEGEL, MATTHEW OSBOURNE		
IPC分类号	G09G3/36 G02F1/1368		
CPC分类号	G02F1/1368 G02F2201/52		
其他公开文献	US20050212741A1		
外部链接	Espacenet USPTO		

摘要(译)

公开了一种显示器和制造所述显示器的方法，其中所述显示器包括至少第一组子像素和第二组子像素 - 所述第一组子像素包括比所述第二子像素更小的区域。驱动所述第一组子像素的薄膜晶体管基本上形成在所述第二组子像素的区域中。