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(54) LIGHT EMITTING DIODE BACKLIGHT MODULE AND LIQUID CRYSTAL DISPLAY

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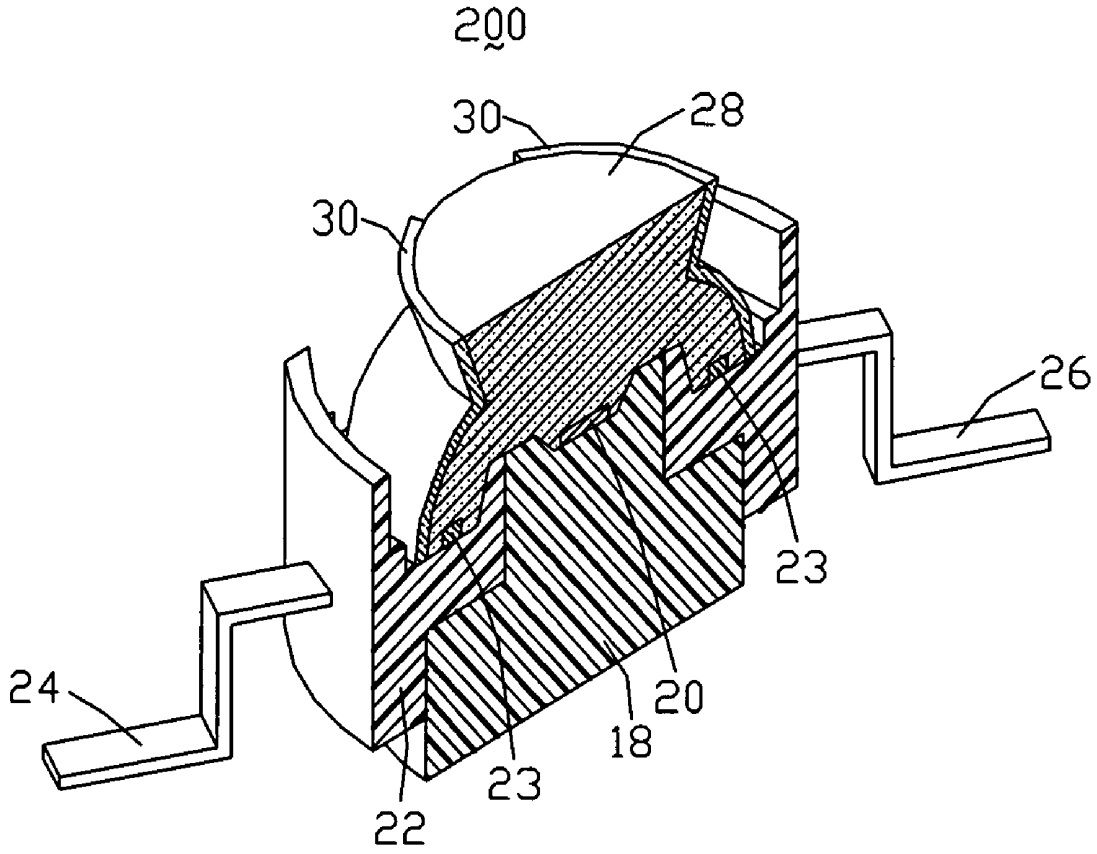
(57) **ABSTRACT**

An exemplary light emitting diode (**200**) includes a base (**18**), a semiconductor chip (**20**), a cover (**28**), and two optical layers (**30**). The semiconductor chip is formed on the base. The cover is formed on the base and covers the semiconductor chip. The optical layers cover part of a peripheral side of the cover respectively.



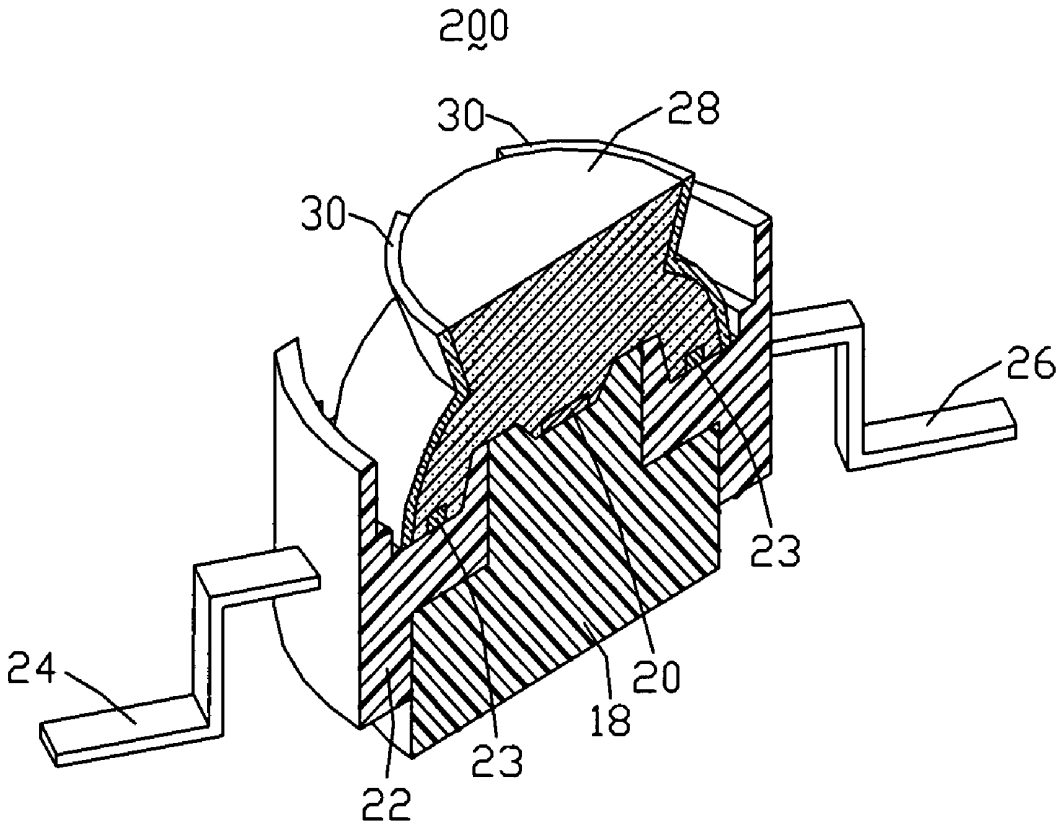


FIG. 1

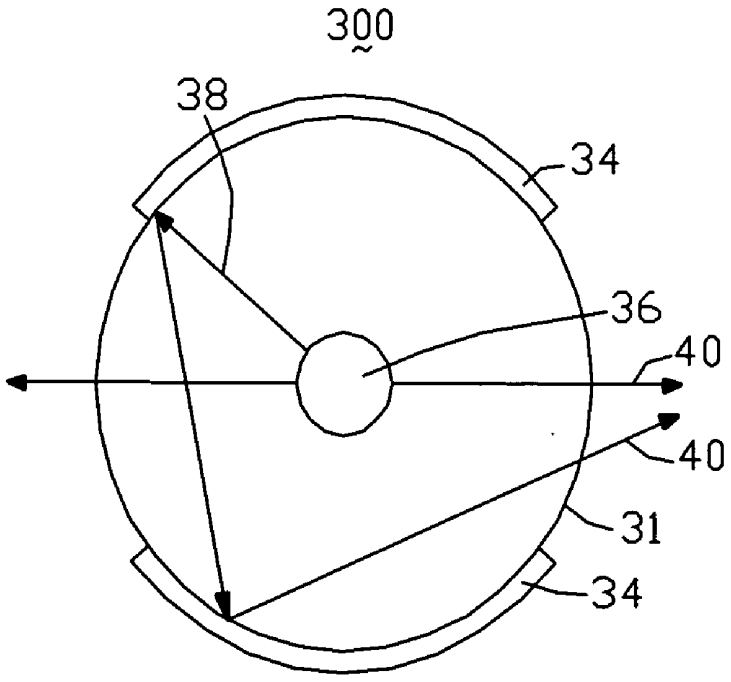


FIG. 2

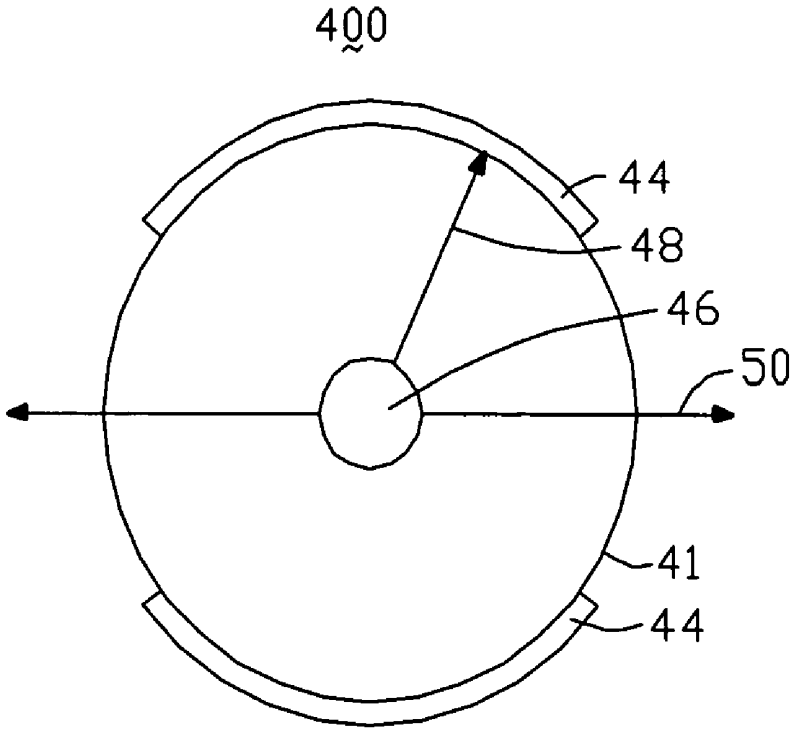


FIG. 3

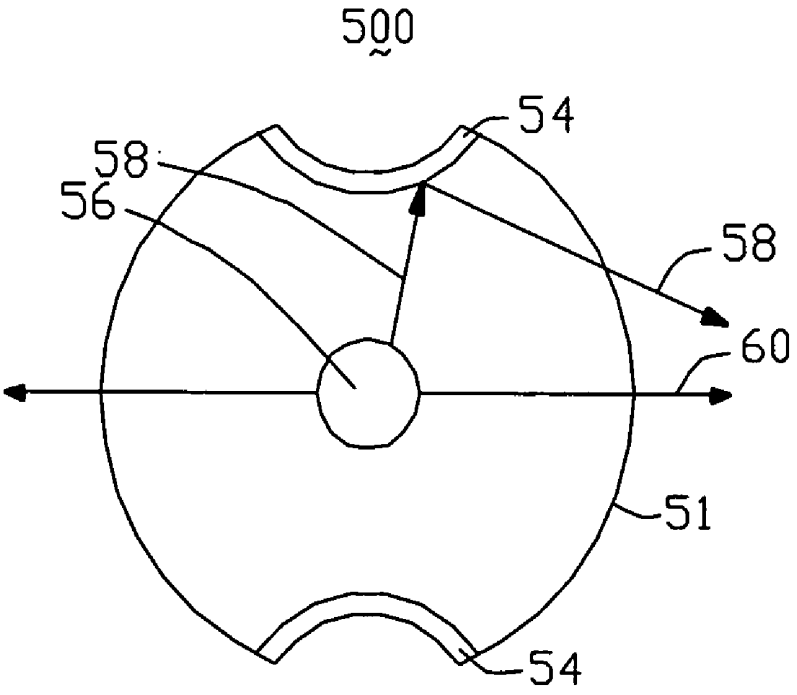


FIG. 4

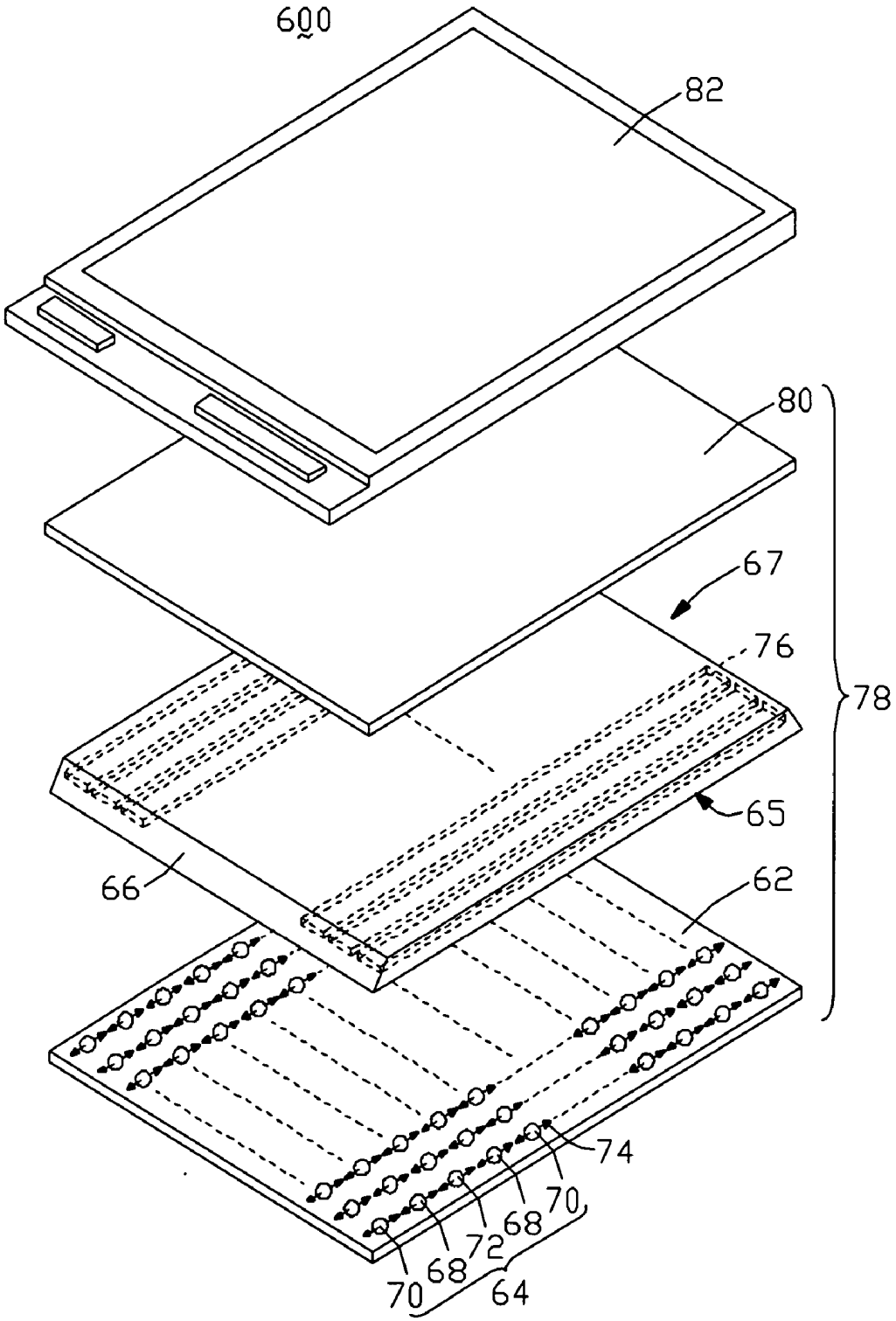


FIG. 5

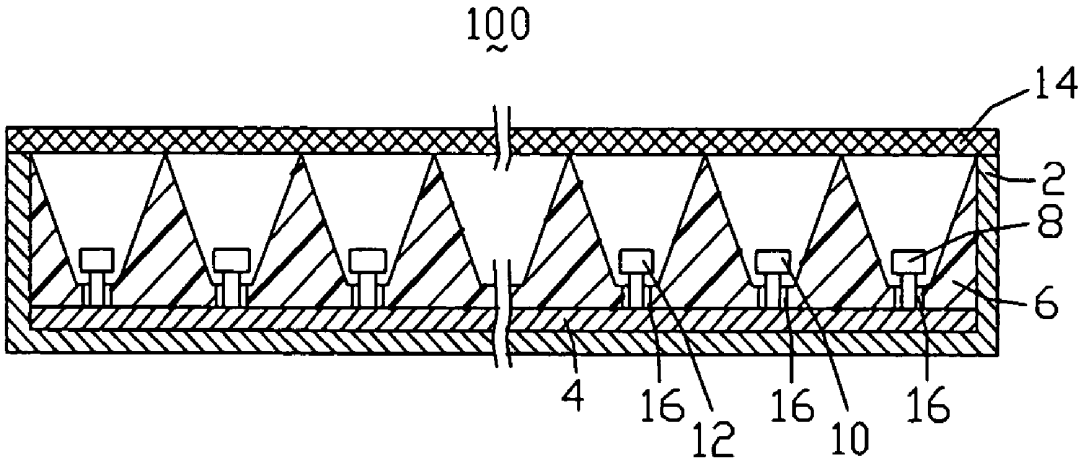


FIG. 6
(RELATED ART)

LIGHT EMITTING DIODE BACKLIGHT MODULE AND LIQUID CRYSTAL DISPLAY

FIELD OF THE INVENTION

[0001] The present invention relates to backlight modules and liquid crystal displays, and more particularly to a light emitting diode (LED), a backlight module and a liquid crystal display using the light emitting diode, which is configured to provide scanning effect thereof.

GENERAL BACKGROUND

[0002] A typical liquid crystal display generally includes a display panel and a backlight module for illuminating the display panel. The backlight module can be classified into non-scanning and scanning backlight module. A non-scanning backlight module illuminates the display panel continuously while the display panel is turned on, but a scanning backlight module is switched on and off alternatively during a period of time while the display panel is turned on. The scanning backlight module includes a plurality of light emitting diodes (LEDs) arranged in a matrix array, which are switched on and off row by row so as to define a scanning effect for preventing the images between two frames of the display panel from image sticking.

[0003] Referring to FIG. **6**, this shows a cross-sectional view of a backlight module **100** for a liquid crystal display. The backlight module **100** includes a reflective frame **2**, a substrate **4**, a plurality of red LEDs **8**, a plurality of green LEDs **10**, a plurality of blue LEDs **12**, and a diffuser **14**. The red, green, and blue LEDs **8**, **10**, **12** emit red, green and blue light beams respectively. The substrate **4** includes a plurality of partitions **6**, and a plurality of slits **16** between the partitions **6**. Each partition **6** has a profile of triangle with a pin portion away from the substrate **4**.

[0004] The substrate **4** is located on the reflective frame **2**, and the red, greed, and blue LEDs **8**, **10**, and **12** are penetrated through the slits **16**. Light beams emitted from the LEDs **8**, **10**, and **12** are confined between two adjacent partitions **6**. Each row of LEDs between two adjacent partitions **6** includes a plurality of the red, greed, and blue LEDs **8**, **10**, and **12**. The partition **6** and the substrate **4** is made from or coated with reflective material, such as, silver. Therefore, the light beams emitted from the red, green, and blue LEDs **8**, **10**, and **12** can be reflected and concentrated between the adjacent partitions **6**, and then almost all the light beams are reflected by the substrate **4** and the partition **6** and enter into the diffuser **14**. The red, green, and blue LEDs **8**, **10**, and **12** are in the same row are switched on and off together.

[0005] Along with the increasing size of the liquid crystal display, the size of the backlight module and the partitions used thereof also increased. The partitions in larger size are liable to warp due to being pressed by the diffuser **14**, thus, the quality of the liquid crystal display is decreased.

[0006] Accordingly, what is needed is a backlight module and a liquid crystal display configured to overcome the above-described problems.

SUMMARY

[0007] An exemplary light emitting diode includes a base, a semiconductor chip, a cover, and two optical layers. The semiconductor chip is formed on the base. The cover is formed on the base and covers the semiconductor chip. The optical layers cover part of a peripheral side of the cover respectively.

[0008] A detailed description of embodiments of the present invention is given below with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] In the drawings, all the views are schematic.

[0010] FIG. **1** is a cross-sectional view of a light emitting diode in accordance with a first embodiment of the present invention.

[0011] FIG. **2** is a top view of a light emitting diode with two reflection layers in accordance of a second embodiment of the present invention.

[0012] FIG. **3** is a top view of a light emitting diode with two absorption layers in accordance of a third embodiment of the present invention.

[0013] FIG. **4** is a top view of a light emitting diode with two reflection layers in accordance of a fourth embodiment of the present invention.

[0014] FIG. **5** is an exploded view of a liquid crystal display with a backlight module in accordance with a preferred embodiment of the present invention.

[0015] FIG. **6** is a cross-sectional view of a conventional backlight of a liquid crystal display.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0016] Referring to FIG. **1**, this shows a cross-sectional view of a light emitting diode in accordance with a first embodiment of the present invention. The light emitting diode **200** includes a base **18**, a semiconductor chip **20**, a reflective frame **22**, two connectors **23**, a first pad **24**, a second pad **26**, a transparent cover **28**, and two optical layers **30**.

[0017] The semiconductor chip **20** is formed on an indentation part of top of the base **18**. The reflective frame **22** is formed on the base **18** and covers a part thereof. The transparent cover **28** is formed on the base **18** and the reflective frame **22**, and covers the semiconductor chip **20**, and a part of the base **18** and reflective frame **22**. The first and second pads **24**, **26** are connected to the semiconductor chip **20** via the connectors **23** formed on the reflective frame **22** respectively.

[0018] The transparent cover **28** includes an upper part (not labeled) and a lower part (not labeled). A profile of the upper part of the cover **28** is substantially similar to a trapezoid, a profile of the lower part of the cover **28** is substantially similar to an ellipse, and the short edges of the upper and lower parts are connected together.

[0019] A power supply (not shown) is connected to the light emitting diode **200** via the first and second pads **24**, **26**, and powers the semiconductor chip **20** through the connectors **23** enabling the semiconductor chip **20** emitting light beams. Light transmittance at a lateral side of the transparent cover **28**, which is parallel to the base, is higher than a light

transmittance at a top side thereof. Thus, a majority of light beams is irradiated out of the transparent cover **28** from the lateral side thereof.

[**0020**] The optical layers **30** are formed at a peripheral side of the cover **28** defining two intervals (not labeled) which are uncover by the optical layers **30** and are opposite to each other between the optical layers **30**. The light beams emitted from the semiconductor chip **20** can only be irradiated out from the cover **28** through the two intervals.

[**0021**] Referring to FIG. **2**, this shows a schematic, top view of a light emitting diode **300** in accordance of a second embodiment of a backlight module of the present invention. The light emitting diode **300** includes a transparent cover **31**, two reflection layers **34**, and a light chip **36**. The light chip **36** is covered by the cover **31**, and the reflection layers **34** are formed on two opposite peripheral sides of the cover **31** defining two intervals (not labeled) which are uncover by the reflection layers **34** and are opposite to each other between the reflection layers **34**. The reflection layer **34** is made from silver, or aluminum which has high light reflection ability.

[**0022**] The light chip **36** emits light beams outwardly, of which, the light beams **40** is irradiated in two directions toward the intervals, and the light beams **38** are reflected by the reflection layer **34** back into the cover **31**. After reflecting several times by the reflection layer **34**, the light beams **38** are emitted out from the cover **31** through the intervals between the reflection layers **34** ultimately.

[**0023**] Referring to FIG. **3**, this shows a schematic, top view of a light emitting diode **400** in accordance of a third embodiment of a backlight module of the present invention. The light emitting diode **400** includes a transparent cover **41**, two absorption layers **44**, and a light chip **46**. The light chip **46** is covered by the cover **41**, and the absorption layers **44** are formed on two opposite peripheral sides of the cover **41** defining two intervals (not labeled) which are uncover by the absorption layers **44** and are opposite to each other between the absorption layers **44**. The absorption layer **44** is made from opaque resin which has light absorption ability.

[**0024**] The light chip **46** emits light beams **48** outwardly, of which, the light beams **50** are irradiated in two directions toward the intervals, and the light beams **48** are absorbed by the absorption layer **44**, and the light **50** is emitted out from the cover **41** through the intervals between the absorption layers **44**.

[**0025**] Referring to FIG. **4**, this shows a schematic, top view of a light emitting diode **500** in accordance of a fourth embodiment of a backlight module of the present invention. The light emitting diode **500** includes a transparent cover **51** with two curve portions (not labeled) formed on the opposite side thereof, two reflection layers **54**, and a light chip **56**. The light chip **56** is covered by the cover **51**, and the reflection layers **54** are formed on two curve portions at two opposite sides of the cover **51** defining two intervals (not labeled) which are uncover by the reflection layers **54** and are opposite to each other between the reflection layers **54**. The reflection layer **54** is made from silver, or aluminum which has high light reflection ability.

[**0026**] The light chip **56** emits radial light beams **58** outwardly, of which, part light beams **60** are irradiated in two directions toward the intervals, and part light beams **58** toward the reflection layers **54** are reflected by the reflection layer **54** back into the cover **51**. After reflecting several times by the reflection layer **54**, the light beams **38** are emitted out from the cover **51** through the intervals between the reflection layers **54** ultimately.

[**0027**] Referring to FIG. **5**, this shows an exploded view of a liquid crystal display **600** with a backlight module in accordance with a preferred embodiment of the present invention. The liquid crystal display **600** includes a liquid crystal panel **82**, and a backlight module **78**. The backlight module **78** includes a substrate **62**, a reflective frame **67**, and a diffuser **80**. The reflective frame **67** is a metal frame coated with reflective material, such as, silver, which includes a base **65**, and a plurality of sides **66**. The base **65** includes a plurality of slits **76** arranged substantially parallel to each other. Each side **66** maintains a predetermined angle relative to the base **65**.

[**0028**] A plurality of LED sets **64** are formed on the substrate **62** at positions according to the slits **76**, which includes two red LEDs **68**, two green light LEDs **70**, and a blue light LED **72** arranged adjacent to each other, and a sequence order thereof is green, red, blue, red, and green LEDs as shown in FIG. **5**. The sequence of the LEDs can also be green, red, blue, and green. The red, green, and blue LEDs **68**, **70**, and **72** can be one of the light emitting diodes **300**, **400**, **500** emitting light beams in a predetermined direction **74** which are parallel to the light beams emitted from different LED set **64**.

[**0029**] The reflective frame **67** is located on the substrate **62**, and the LED sets **64** are contained in the corresponding slits **76**. The diffuser **80** is arranged on the reflective frame **67**, and the liquid crystal panel **82** is arranged on the backlight module **78**.

[**0030**] The light beams emitted from the red, green, and blue LEDs **68**, **70**, and **72** are reflected by the reflective frame **67** and combined together as a white light beam, then transmit toward the diffuser **80**. The light beams are scatter uniformly by the diffuser **80**, and then enters the liquid crystal panel **82** for displaying images.

[**0031**] In alternative embodiments, the reflection layers **34**, **54** is not limited to silver or aluminum, it can also be any kind of material that has light reflection ability. The absorption layer **44** is not limited to opaque resin, but can be any kind of material that has light absorption ability.

[**0032**] The light emitting diodes **300**, **400**, and **500** arranged on the substrate in lines emits light only in desired directions, therefore, the light emitted from the light emitting diodes arranged in line do not interference others lined light emitting diodes. Thus a step and cost to form the partitions can be saved.

[**0033**] While preferred and exemplary embodiments have been described above, it is to be understood that the invention is not limited thereto. To the contrary, the above description is intended to cover various modifications and similar arrangements as would be apparent to those skilled in the art. Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

What is claimed is:

1. A light emitting diode, comprising:

a base;

a semiconductor chip formed at the base;

a cover formed at the base and covering the semiconductor chip; and

two optical layers covering part of a peripheral side of the cover respectively.

2. The light emitting diode as claimed in claim 1, wherein the cover comprises an upper part with a profile of trapezoid, and a lower part with a profile of an ellipse.

3. The light emitting diode as claimed in claim 1, wherein the cover comprises two curve portions arranged opposite to each other.

4. The light emitting diode as claimed in claim 1, wherein the optical layer is formed at the curve portion.

5. The light emitting diode as claimed in claim 1, wherein the optical layer is made from silver, or aluminum.

6. The light emitting diode as claimed in claim 1, wherein the optical layer is made from opaque resin.

7. A backlight module, comprising:

a base comprising a plurality of light emitting diodes, the light emitting diodes having a cover with two optical layer formed thereon; and

a frame comprising a base and a side;

wherein the frame is arranged at the base.

8. The backlight module as claimed in claim 7, wherein the cover comprises an upper part with a profile of trapezoid, and a lower part with a profile of an ellipse.

9. The backlight module as claimed in claim 7, wherein the cover comprises two curve portions arranged opposite to each other.

10. The backlight module as claimed in claim 7, wherein the optical layer is formed at the curve portion.

11. The backlight module as claimed in claim 7, wherein the optical layer is made from silver, or aluminum.

12. The backlight module as claimed in claim 7, wherein the optical layer is made from opaque resin.

13. The backlight module as claimed in claim 7, wherein the base comprises a plurality of slits, and the light emitting diodes is arranged through the slits.

14. The backlight module as claimed in claim 7, further comprising a diffuser arranged at the frame.

15. A liquid crystal display, comprising:

a backlight module comprising a plurality of light emitting diodes, the light emitting diodes having a cover with two optical layer formed thereon; and

a liquid crystal panel arranged at the backlight module.

16. The liquid crystal display as claimed in claim 15, wherein the cover comprises an upper part with a profile of trapezoid, and a lower part with a profile of an ellipse.

17. The liquid crystal display as claimed in claim 15, wherein the cover comprises two curve portions arranged opposite to each other.

18. The liquid crystal display as claimed in claim 15, wherein the optical layer is formed at the curve portion.

19. The liquid crystal display as claimed in claim 15, wherein the optical layer is made from silver, or aluminum.

20. The liquid crystal display e as claimed in claim 15, wherein the optical layer is made from opaque resin.

* * * * *

专利名称(译)	发光二极管背光模块和液晶显示器		
公开(公告)号	US20070146573A1	公开(公告)日	2007-06-28
申请号	US11/645456	申请日	2006-12-26
[标]申请(专利权)人(译)	群创光电股份有限公司		
申请(专利权)人(译)	群创光电股份有限公司.		
当前申请(专利权)人(译)	群创光电		
[标]发明人	YANG KUN HSIEN TUNG CHIEN FAN		
发明人	YANG, KUN-HSIEN TUNG, CHIEN-FAN		
IPC分类号	G02F1/1335		
CPC分类号	H01L33/54 H01L33/58 H01L33/60		
优先权	094146365 2005-12-23 TW		
其他公开文献	US7989829		
外部链接	Espacenet USPTO		

摘要(译)

示例性发光二极管（200）包括基座（18），半导体芯片（20），盖（28）和两个光学层（30）。半导体芯片形成在基座上。盖子形成在基座上并覆盖半导体芯片。光学层分别覆盖盖子的周边侧的一部分。