

LATERAL-TYPE BACK-LIGHT USING LIGHT EMITTING DIODE

Field of the present invention:

The present invention relates generally to a lateral back-light using light emitting diode (LED), more particularly, to a lateral back-light using LED which can reduce the cost and thickness of unit, and has enhanced reliability and brightness.

Background of the present invention

Back light is usually used to provide light source for liquid crystal display means such as menu window or notebook computer, and can enhance visual effect in dark place. The conventional back light comprises a light guide and a plurality of LEDs.

The light guide is generally arranged upon a mounting stage on the circuit board, which has a plurality of LEDs as light source. The surface of the light guide is generally subjected to a carving process to form a misted surface, and the LEDs are generally placed below the light guide.

Fig. 1 shows one conventional COB-type (chip on board type) lateral back light using LEDs. The LED chip 1a is directly mounted to the printed circuit board (PCB) 1b. After the wire-bonding process of the chip 1a, silicone glue is dipped manually to the back light. The back light is then assembled to the lateral side of the PCB, that is mounted dice.

In above-mentioned COB-type back light, the manufacturing process is difficult due to the narrow shape of the PCB. The molding process of PCB for above-mentioned COB-type back light is a push back type molding, which is more expensive than the punch molding. Moreover, the COB-type arrangement is difficult to automatic production and has poor reliability due to the ruggedness thereof.

Figs. 2 and 3 show another conventional SMD-type lateral back light. Two SMD-type LEDs 2a (3a) function as light sources and are arranged on the PCB 2b (3b) through soldering. The resulting structure is then bounded to the lateral side of the light guide by silicone glue.

The above-mentioned SMD-type lateral back light can solve the problem

of automatic production, chip mounting, and wire bonding met by the COB-type back light. However, the SMD-type back light needs a further SMT process, therefore, the thickness of unit is excessively large and the cost is increased.

5 Another conventional lateral back light using LEDs is leadframe-type back light (not shown). That contains white reflector, and it is assembled to the lateral side of the light guide by glue. However, the soldering work becomes cumbersome if the number of light sources is increased.

The above three kinds of lateral back light which we discussed have the
10 problem of excessively high thickness. For example, the thickness of the PCB-type and the leadframe-type back light are 1.8mm and 1.3mm, respectively. Because the back lights are generally dipped by silicone glue, they are liable to be damaged if being touched directly to the surface thereof. This increases the processing difficulty. Even though an EL back light with thickness below
15 0.6mm can also be used as light source. However, the EL back light has the problem of poor brightness. Therefore, a high voltage/current driving is required.

The object of the present invention is to provide a lateral-type LED back light, the thickness thereof is only 0.4mm-0.6mm, similar to that of EL back
20 light. Therefore, the material consumption is only one third of unit made by conventional punching process. Moreover, it is no need to reserve additional area for PCB or leadframe.

The lateral-type LED back light according to the present invention comprises a light guide, at least one PCB, and a plurality of LEDs, and is
25 assembled in following manner. First, the LEDs are mounted on the PCB panel and then subjected to a wire-bonding process. Afterward, plastic material is formed on the top of the LEDs by epoxy filling or molding. The PCB panel with LEDs is then punched or cut into a plurality of strip-shaped circuit boards. Finally, the strip-shaped circuit board with LEDs is assembled to one lateral
30 side of the light guide, thus forming the lateral LED back light of the present invention. Alternatively, the strip-shaped circuit board and the light guide can

be formed integrally by mold injection or molding.

The plastic material arranged on the top of the LEDs can be of rectangular, round, or ellipse shape such that the light propagating within the light guide can emit from front side uniformly and then enhance brightness.

- 5 The various objects and advantages of the present invention will be more readily understood from the following detailed description when read in conjunction with the appended drawings, in which:

Brief description of drawings:

Fig. 1 is a perspective view showing a conventional COB-type back
10 light;

Fig. 2 is a perspective view showing a conventional SMD-type back light;

Fig. 3 is a perspective view showing another conventional SMD-type back light;

15 Fig. 4 is a perspective view showing the back light before cutting process according to the present invention;

Fig. 5 is another perspective view showing the back light before cutting process according to the present invention;

Fig. 6 is a perspective view showing another back light before cutting
20 process according to the present invention;

Fig. 7 is the exploded view of the preferred embodiment according to the present invention;

Fig. 8 is a perspective view showing the preferred embodiment according to the present invention in a combined state; and

25 Fig. 9 is the perspective view of another preferred embodiment according to the present invention.

Numerals

1a LED chip

1b PCB

30 2a 3a LED light source

2b 3b PCB

- 41 LED
- 43 PCB panel
- 45 strip-shaped circuit board
- 51 LED
- 5 55 PCB strip
- 61 LED
- 63 PCB panel
- 65 strip-shaped circuit board
- 71 LED
- 10 75 PCB strip
- 79 light guide
- 81 LED
- 85 PCB strip
- 89 light guide
- 15 **Detailed description of the preferred embodiment**

Fig. 4 is a perspective view showing the back light according to the present invention and the state thereof before cutting process. The PCB panel 43 can adopt ceramic base, aluminum base, flexible PCB etc. First, the PCB panel 43 is pressed to be a rectangular shape, a square shape or a V shape and formed holes thereon. A plurality of LEDs, arranged alternatively, are then mounted to the PCB panel 43, this arrangement is suitable for pressing and cutting process. Then the wire bonding processed is carried on.

Then, molding process is carried out to form a plastic material on the top of the LED 41. The plastic material can be rectangular shape, round shape or elliptic shape. Then the PCB panel 43 is cut into a plurality of strip-shaped circuit board 45. The strip-shaped circuit board 45 can be formed various shape to match the light guide to be assembled.

Fig. 5 is a perspective view showing the back light according to the present invention and the state thereof before cutting process. The PCB panel 53 can adopt ceramic base, aluminum base, flexible PCB etc. First, the PCB panel 53 is pressed to a rectangular shape, a square shape or a V shape and

formed hole thereon. A plurality of LEDs 51, arranged continuously, are then mounted to the PCB panel 53, this arrangement is suitable for cutting process. Then the wire bonding processed is carried on.

Then, molding process is carried out to form a plastic material on the top of the LED 51. The plastic material can be rectangular shape, round shape or elliptic shape. Then the PCB panel 53 is cut into a plurality of PCB strip 55. The PCB strip 55 can be formed various shape to match the light guide to be assembled.

Fig. 6 is a perspective view showing another back light before cutting process according to the present invention. The shape of plastic material can be the same shape of various SMD LED. The PCB panel 63 can adopt ceramic base, aluminum base, flexible PCB etc. First, the PCB panel 63 is pressed to a rectangular shape, a square shape or a V shape and formed hole thereon. A plurality of LEDs 61 are then mounted to the PCB panel 53. Then the wire bonding processed is carried on.

Afterward, molding process is carried out to form a plastic material on the top of the LED 61. The plastic material can be rectangular shape, round shape or elliptic shape. Then the PCB panel 63 is cut into a plurality of strip-shaped circuit board 65. The strip-shaped circuit board 65 can be formed various shape to match the light guide to be assembled.

The plastic material is used to guide the light of LEDs into the light guide, and can be made of silicon, silicon rubber, silicon compound, epoxy, resin, acrylic resin etc. The plastic material arranged on the top of the LEDs can be of rectangular, round, or ellipse shape such that the light propagating within the light guide can emit from front side uniformly with enhanced brightness.

Fig. 7 is the exploded view of the preferred embodiment according to the present invention, and fig. 8 is a perspective view showing the preferred embodiment in a combined state. The lateral-type LED back light according to the present invention comprises a light guide 79, at least one PCB strip 75, and a plurality of LEDs 71.

The PCB strip 75 with LEDs 71 is manufactured in above process, then arranged on one lateral side of the light guide 79. Therefore, the LEDs 71 are also arranged on one lateral side of the light guide 79. The lateral LED back light is brighter than that of conventional COB-type by 30% and is similar to that of SMD type. Moreover, the thickness is reduced in comparison to SMD type.

Fig. 9 is the perspective view of another preferred embodiment according to the present invention. By mold injection or molding, the PCB strip 85 equipped with LEDs 71 can be formed integrally with the light guide 89. With above integral arrangement, there is no air gap between the LEDs and the light guide, thus increasing brightness. The brightness of the back light according to the present invention is higher than that of SMD type and has reduced thickness 0.4mm-0.6mm.

The cost of the back light according to the present invention is reduced because the space between circuit boards is saved, and the process of push back mold and mold are omitted. Moreover, the electrodes of back light can be directly soldered to the circuit board, therefore, the SMD process is dispensed.

To sum up, the back light according to the present invention can be manufactured by a simplified process with high reliability and the brightness is enhanced with compact size.

Although the present invention has been described with reference to the preferred embodiments thereof, it will be understood that the invention is not limited to the details thereof. Various substitutions and modifications have suggested in the foregoing description, and other will occur to those of ordinary skill in the art. Therefore, all such substitutions and modifications are intended to be embraced within the scope of the invention as defined in the appended claims.

**Claims:**

1. A lateral-type LED back light comprises a light guide, at least one strip-shaped circuit board, and a plurality of LEDs; wherein the LEDs are mounted on a PCB panel and have rectangular plastic material formed by epoxy filling or molding thereon; the PCB panel with LEDs is then punched or cut into a plurality of strip-shaped circuit boards which is subsequently assembled to one lateral side of the light guide.
2. The lateral-type LED back light as in claim 1, wherein said strip-shaped circuit board and said light guide are formed integrally.
3. A lateral-type LED back light comprises a light guide, at least one strip-shaped circuit boards, and a plurality of LEDs; wherein the LEDs are mounted on a PCB panel and have round plastic material formed by epoxy filling or molding thereon; the PCB panel with LEDs is then punched or cut into a plurality of strip-shaped circuit boards which is subsequently mounted on one lateral side of the light guide.
4. The lateral-type LED back light as in claim 3, wherein said strip-shaped circuit board and said light guide are formed integrally.
5. A lateral-type LED back light comprises a light guide, at least one strip-shaped circuit boards, and a plurality of LEDs; wherein the LEDs are mounted on a PCB panel and have ellipse plastic material formed by epoxy filling or molding thereon; the PCB panel with LEDs is then punched or cut into a plurality of strip-shaped circuit boards which is subsequently assembled to one lateral side of the light guide.
6. The lateral-type LED back light as in claim 5, wherein said strip-shaped circuit board and said light guide are formed integrally.