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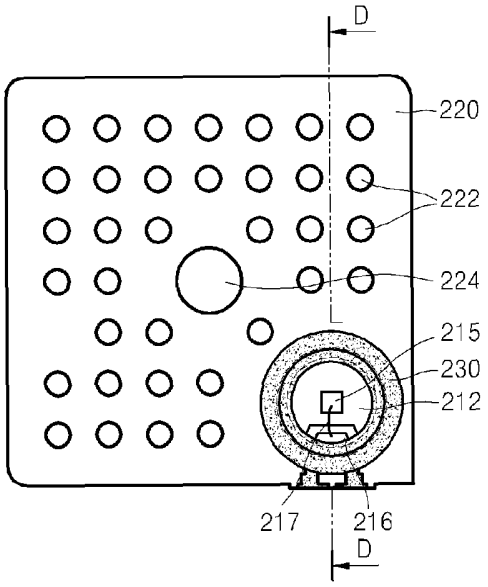
(54) **Title:** LIGHT EMITTING DIODE PACKAGE HAVING UNIFIED HEAT SINK PLATE AND MULTI-PACKAGE MODULE



(57) **Abstract:** A light emitting diode package having a unified heat sink plate and a multi-package module are provided. The light emitting diode package comprises a chip bonding pad on which a light emitting diode chip is to be mounted, at least one lead electrically connected to the light emitting diode chip and insulated from the chip bonding pad, an insulation body formed around the chip bonding pad, fixing the lead and having a light emitting window through which light emitted from the light emitting diode chip passes, a heat sink plate integrated into the chip bonding pad, protruding from an outside of the insulation body and dissipating operating heat of the light emitting diode chip, and a plurality of division holes which are formed between the chip bonding pad and the heat sink plate and have a stepped shape and into which a resin is injected when the insulation body is formed, wherein the heat sink plate occupies more than a fourth part of the entire outer circumference of the insulation body. Through the above structure, since there is no worry about moisture-absorption and exfoliation, the heat sink plate can be formed to have a large area so that a heat dissipation effect is improved and a plurality of light emitting diode packages are arranged on one large-area heat sink plate and can be modularized.

WO 2006/123911 A1

Description

LIGHT EMITTING DIODE PACKAGE HAVING UNIFIED HEAT SINK PLATE AND MULTI-PACKAGE MODULE

Technical Field

[1] The present invention relates to a light emitting diode package and a multi-package module, and more particularly, to a light emitting diode package in which a heat sink plate having a large area that protrudes and extends to an outside of a package insulating body is integrated into a chip bonding pad, so as to effectively dissipate operating heat of a light emitting diode chip, and a multi-light emitting diode package module in which a plurality of packages are arranged on a unified heat sink plate.

Background Art

[2] FIG. 1 illustrates an example of a conventional high-output light emitting diode package 10.

[3] The light emitting diode package 10 includes a heat sink plate 20 on which a light emitting diode chip 13 is to be mounted and which dissipates operating heat of the light emitting diode chip 13, and a lead 17 which is electrically connected to the light emitting diode chip 13 via a wire bonding 14 and extends to a package external terminal.

[4] The lead 17 and the heat sink plate 20 are fixed by an insulating body 22, and a reflective cup 24 for condensing light emitted from the light emitting diode chip 13 and a transparent light emitting window 26 through which light passes while protecting the light emitting diode chip 13 are provided in the insulating body 22.

[5] The heat sink plate 20 is a heat sink having an exposed bottom surface. Heat is emitted to a bottom surface of a package via the heat sink. This structure is a structure in which a lead frame is pre-formed while a space for inserting a heat sink plate is left. If the heat sink plate is inserted into the pre-formed lead frame, the structure has physical vulnerability such as moisture-absorption and exfoliation. Also, the heat sink plate should be separately manufactured and thus, productivity is lowered. In addition, heat dissipation is limited to an exposed portion of the bottom surface of the package via the heat sink plate 20. Thus, a heat diffusion and dissipation effect is lowered and a heat dissipation efficiency is low.

[6] In a high-output light emitting diode package, the performance and life span of a light emitting diode chip depends on a heat dissipation performance. One of reasons that the use of a light emitting diode has increased instead of other light sources is that the life span of the light emitting diode is longer than other light sources. However, in a current light emitting diode, about 80% of consumed power is consumed by heat.

When the heat is not rapidly cooled, the performance and life span of the light emitting diode are degraded. In general, when the surface temperature of the light emitting diode chip exceeds 120 ℃ , a normal life span of the light emitting diode cannot be guaranteed. Thus, the heat sink plate is unified with the package and an additional heat sink plate is further attached so that the heat dissipation performance of the package can be improved.

[7] In order to separately install the large-capacity heat sink plate, an installation space larger than the size of a separate package is needed. However, when the heat dissipation performance is more important than light-weight, thin, short and small-size according to the use purpose, condition and environment of a high-output light emitting diode package, the large-capacity heat sink plate may be provided for a high heat dissipation. However, when the heat sink plate is unified with the light emitting diode package, there are difficulties in realizing technology in various fields such as moisture-absorption, structural reliability, reproducibility, mass productivity, and economical efficiency.

[8] FIG. 2 illustrates a structure in which a smaller heat sink plate 32 than an insulating body 30 is provided and a package is attached to a heat dissipation printed circuit board (PCB) so as to support heat dissipation. A heat conduction path from a light emitting diode is shown in FIG. 2. A light emitting diode chip 37 is mounted on the heat sink plate 32 and a lead terminal 40 that is electrically connected to the light emitting diode chip 37 extends via a side surface of the insulating body 30 and is exposed.

[9] In a light emitting diode package having the heat sink plate 32, the heat sink plate 32 is isolated in the insulating body 30 and is exposed only to the bottom surface of the package and heat generated in a light emitting diode chip is conducted to a lower portion of the package with a smaller area than the insulating body 30. When a lead terminal connected to one electrode of two electrodes of the light emitting diode is integrated into the heat sink plate 32 or is combined with the heat sink plate 32, heat is also dissipated to a lateral side of the package via the lead terminal. However, a direct heat dissipation effect is not high.

[10] In the case of a high-output light emitting diode chip of about 1 watt of consumed power rating, due to excessive operating heat of the light emitting diode chip, a disastrous damage occurs at a half level of rating consumed power of the light emitting diode chip. Even though the package is mounted on the PCB, if there is no special heat dissipation device, an input current should be limited to be less than a rating, so as to safely use the light emitting diode.

[11] Thus, a light emitting diode package is mounted on a heat dissipation printed circuit board (PCB) 33 in which a metal plate 35 is attached to a lower portion of the

thin PCB 33 by an insulating adhesive material 34. However, since, in the structure, the heat sink plate having a sufficient heat dissipation performance cannot be unified with the light emitting diode package, a heat dissipation path is limited and an adhesive material having a comparatively high thermal resistance on the heat conduction path is inserted such that a heat dissipation efficiency is lowered.

[12] FIGS. 3A, 3B, and 3C illustrate a conventional light emitting diode package having an improved heat dissipation performance by introducing a heat sink plate structure in a conventional package for a power device. Here, to address the problems, a heat sink plate 53 unified with the package extends to an outside of a insulating body 50 of the package. Unexplained reference numeral 55 denotes a lead terminal electrically connected to a chip. Although a heat sink plate is formed with the package in a single unit, due to exfoliation of an interface between the insulating body 50 and the heat sink plate 53 of the package and moisture-absorption, there is a limitation in increasing a contact area between the heat sink plate 53 and the insulating body 50 or the area of the heat sink plate 53.

Disclosure of Invention

Technical Problem

[13] Thus, the heat sink plate 53 does not occupy the entire width of one side surface 50a of a rectangular package but is limited to a portion thereof and thus, there is a limitation in performing sufficient heat dissipation.

Technical Solution

[14] The present invention provides a light emitting diode package in which

[15] exfoliation of an interface between an insulating body and a heat sink plate of the package and moisture-absorption are prevented so that a large-area heat sink plate extends to a circumference of the insulating body and a heat dissipation performance of a high-output light emitting diode is improved, and a light emitting diode package module in which a plurality of package insulating bodies are arranged on one large-area heat sink plate to be separated from one another by a predetermined distance.

[16] According to an aspect of the present invention, there is provided a light

[17] emitting diode package comprising: a chip bonding pad on which a light emitting diode chip is to be mounted; at least one lead electrically connected to the light emitting diode chip and insulated from the chip bonding pad; an insulation body formed around the chip bonding pad, fixing the lead and having a light emitting window through which light emitted from the light emitting diode chip passes; a heat sink plate integrated into the chip bonding pad, protruding from an outside of the insulation body and dissipating operating heat of the light emitting diode chip; and a plurality of division holes which are formed between the chip bonding pad and the heat

sink plate and have a stepped shape and into which a resin is injected when the insulation body is formed, wherein the heat sink plate occupies more than a fourth part of the entire outer circumference of the insulation body.

[18] The insulation body may have a circular shape.

[19] The division holes that are closer to the insulation body may have a smaller

[20] width than the division holes that are distant from the insulation body.

[21] According to another aspect of the present invention, there is provided a light

[22] emitting diode package comprising: a chip bonding pad on which a light emitting diode chip is to be mounted; at least one lead electrically connected to the light emitting diode chip and insulated from the chip bonding pad; an insulation body formed around the chip bonding pad, fixing the lead and having a light emitting window through which light emitted from the light emitting diode chip passes; a heat sink plate integrated into the chip bonding pad, protruding from an outside of the insulation body and dissipating operating heat of the light emitting diode chip; and a plurality of division holes which are formed between the chip bonding pad and the heat sink plate and have a stepped shape and into which a resin is injected when the insulation body is formed, wherein the insulation body has a rectangular shape and the heat sink plate occupies at least one side surface of a rectangular circumference of the insulation body.

[23] The lead may form a bottom surface having the same level as the chip bonding pad and the heat sink plate.

[24] The heat sink plate may comprise a plurality of through holes so as to increase a heat dissipation area and to easily perform soldering.

[25] The insulation body may be formed in a center of the heat sink plate or may be formed to be eccentric with the heat sink plate.

[26] The heat sink plate may have a rectangular shape and the insulation body may be formed at an edge or a corner of the heat sink plate.

[27] According to another aspect of the present invention, there is provided a multi-light emitting diode package module comprising: a large-area heat sink plate dissipating operating heat of a light emitting diode chip; and a plurality of light emitting diode packages arranged on the heat sink plate to be separated from one another by a pre-determined distance, wherein each of the light emitting diode packages comprises: a chip bonding pad which is integrated into the heat sink plate and which is separated from the heat sink plate by zones by a plurality of division holes having a stepped shape and on which the light emitting diode chip is to be mounted; at least one lead electrically connected to the light emitting diode chip and insulated from the chip bonding pad; and an insulation body formed around the chip bonding pad, fixing the lead and having a light emitting window through which light emitted from the light

emitting diode chip pass.

Advantageous Effects

[28] In the light emitting diode package according to the present invention, a heat sink plate is formed to have a large area as possible so as to maximize a heat dissipation performance. This is because the heat sink plate and a chip bonding pad are formed in a single unit and an insulation body is formed thereon and a plurality of stepped division holes are formed so as to be strongly combined with the insulation body so that exfoliation with the insulation body formed thereon can be prevented. Furthermore, a plurality of light emitting diode packages are arranged on one large-area heat sink plate and can be modularized.

[29] In the light emitting diode package according to the present invention, a large-capacity heat sink plate is provided such that the life span of a light emitting diode is increased, the light emitting diode package is safely and effectively used in malfunction caused by heat dissipation and a heat dissipation system need not to be added and a process of attaching an additional heat sink plate and a material used in the process are reduced.

[30] In addition, when a plurality of light emitting diode packages are modularized, a heat dissipation effect is large. Thus, even though an expensive metal plate-based heat dissipation printed circuit board (PCB) is not used but a general PCB formed of a resin is used, a heat dissipation performance is sufficiently guaranteed such that costs of applied products using a light emitting diode package are reduced.

[31] While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims.

Description of Drawings

[32] The above and other features and advantages of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

[33] FIG. 1 illustrates a conventional light emitting diode package;

[34] FIG. 2 illustrates a heat conduction path in a structure in which the conventional lig ht emitting diode package is mounted on a heat dissipation printed circuit board (PCB);

[35] FIG. 3A illustrates a conventional light emitting diode package having a heat sink plate;

[36] FIG. 3B is a cross-sectional view of FIG. 3A;

[37] FIG. 3C is a bottom surface view of FIG. 3A;

[38] FIG. 4A is a plane view of a lead frame of a light emitting diode package according to an embodiment of the present invention;

[39] FIG. 4B is a bottom surface view of FIG. 4A;

[40] FIG. 4C is a cross-sectional view taken along line A-A of FIG. 4A;

[41] FIG. 5A is a plane view of a light emitting diode package according to an embodiment of the present invention;

[42] FIG. 5B is a bottom surface view of FIG. 5A;

[43] FIG. 5C is a cross-sectional view taken along line B-B of FIG. 5A;

[44] FIG. 6 illustrates the case where an insulating body is formed in a rectangular shape, in the light emitting diode package illustrated in FIG. 5A;

[45] FIG. 7A is a plane view of a lead frame of a light emitting diode package according to another embodiment of the present invention;

[46] FIG. 7B is a bottom surface view of FIG. 7A;

[47] FIG. 8 is a cross-sectional view taken along line C-C of FIG. 7A;

[48] FIG. 9A is a plane view of a light emitting diode package according to another embodiment of the present invention;

[49] FIG. 9B is a bottom surface view of FIG. 9A;

[50] FIG. 10 is a cross-sectional view taken along line D-D of FIG. 9A;

[51] FIG. 11 is a layout view of the light emitting diode package illustrated in FIG. 9A in which adjacent light emitting diode chips are close to one another;

[52] FIG. 12A is a plane view of a multi-light emitting diode package module according to an embodiment of the present invention;

[53] FIG. 12B is a bottom surface view of FIG. 12A;

[54] FIG. 13A illustrates another modified example of the multi-light emitting diode package module illustrated in FIG. 12A;

[55] FIG. 13B is a bottom surface view of FIG. 13A; and

[56] FIG. 14 illustrates the case where a light emitting diode package is mounted on a printed circuit board (PCB).

Mode for Invention

[57] The present invention will now be described more fully with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown.

[58] In a light emitting diode package having a unified heat sink plate according to the present invention, a heat sink plate for dissipating heat generated from a light emitting diode chip is integrated into a chip bonding pad on which the light emitting diode chip is to be mounted and is exposed to an outside of an insulating body.

[59] FIG. 4A is a plane view of a lead frame 100 of a light emitting diode package according to an embodiment of the present invention, and FIG. 4B is a bottom surface view of FIG. 4A. The lead frame 100 includes a plurality of unit lead frames 110. The

lead frame 100 is cut along a portion indicated by a cut line L and thus is individualized into the unit lead frames 110.

[60] The unit lead frames 110 include a chip bonding pad 112 on which a light emitting diode chip that will be described later is to be mounted, a heat sink plate 120 formed with the chip bonding pad 112 in a single unit and partitioned off by a plurality of division holes 118 from the chip bonding pad 112, and a lead 116 that is insulated from the chip bonding pad 112 and the heat sink plate 120 by an insulation hole 114 and is electrically connected to the light emitting diode chip.

[61] The heat sink plate 120 is formed around the chip bonding pad 112 so as not to contact the lead 116 and has a relatively larger area compared to the chip bonding pad 112. The heat sink plate 120 can be manufactured in various shapes. The chip bonding pad 112 may be located in the center of the heat sink plate 120 or to be eccentric with the heat sink plate 120. In addition, the heat sink plate 120 has a plurality of through holes 122 so as to improve a heat dissipation effect by increasing a surface area for heat dissipation and has a combination hole 124 used in combining the package with another structure.

[62] The lead 116 is electrically connected to one electrode of the light emitting diode chip by a bonding wire. The chip bonding pad 112 and the heat sink plate 120 are electrically connected to the other electrode of the light emitting diode chip and supply power required for driving the light emitting diode chip. Here, only one lead is formed but the present invention is not limited to this and a plurality of leads may be provided.

[63] A connection portion 119 disposed between the insulation hole 114 and the division hole 118 connects the chip bonding pad 112 and the heat sink plate 120. The connection portion 119 minimizes a moisture-absorption path between the heat sink plate 120, the chip bonding pad 112 and an insulation body that will be described later and exfoliation. In order to spray and dissipate heat in all directions, the connection portion 119 is formed in several portions around the chip bonding pad 112. That is, the connection portion 119 is formed in at least two portions in the insulation hole 114 and the division hole 118 so that the heat sink plate 120 can be stably fixed. In addition, heat transmitted from the chip bonding pad 112 can be more effectively transmitted to the heat sink plate 120 via the connection portion 119. In this way, one connection portion 119 having a small width is formed in several portions around the chip bonding pad 112 so that reliability for a decrease of exfoliation and moisture-absorption can be increased and a bottleneck situation during heat dissipation can be alleviated.

[64] Referring to FIG. 4C, the division hole 118 includes a portion 118a having a smaller width (hereinafter, referred to as a relatively narrower portion) disposed on an upper side on which the light emitting diode chip is to be mounted, and a portion 118b having a larger width (hereinafter, referred to as a relatively wider portion) disposed on

a lower side. The division hole 118 is formed in a stepped shape. The insulation hole 114 also includes a portion 114a having a smaller width disposed on an upper side of the insulation hole 114 and a portion 114b having a larger width disposed on a lower side of the installation hole 114.

[65] In addition, the portion 114b of the insulation hole 114 and the portion 118b of the division hole 118 each having a larger width are connected to each other. Thus, a plastic resin for insulation body molding is connected by the portions 114b and 118b, and thus the insulation body can be more strongly combined with the heat sink plate 120.

[66] FIG. 5A is a plane view of a light emitting diode package in which a plastic resin is injected into the insulation hole 114 and the division hole 118 and an insulation body 130 is formed around the chip bonding pad 112, FIG. 5B is a bottom surface view of FIG. 5A, and FIG. 5C is a cross-sectional view taken along line B-B of FIG. 5A.

[67] Referring to FIG. 5C, the insulation body 130 surrounds the chip bonding pad 112 and a light emitting diode chip 115 is mounted on the chip bonding pad 112. Here, the light emitting diode chip 115 may be directly mounted on the chip bonding pad 112 or may be attached to a submount (not shown).

[68] As described above, the insulation hole 114 and the division hole 118 are formed in a stepped shape so that the moisture-absorption path formed between the insulation body 130 and the chip bonding pad 112 extends and is complicated. Thus, moisture in-flow from the outside can be effectively prevented. In addition, the insulation body 130 can be more strongly combined with the chip bonding pad 112 and the heat sink plate 120 through the relatively narrower portions 114a and 118a and the relatively wider portions 114b and 118b. Relatively narrower portions and relatively wider portions are formed in the insulation hole 114 and the division hole 118 so that a portion closer to the insulation body 130 has a smaller width that that of a portion distant from the insulation body 130 so that a combination force of the insulation body 130 and the heat sink plate 120 is increased and exfoliation is suppressed. The lead frame 110 according to the present invention may be thicker than 0.2-0.25 mm which is a thickness of a general lead frame. That is, the lead frame 110 may be formed to a thickness of about more than 0.4 mm, 0.5 mm, or 0.76 mm. This is because, when cross-sectional shapes of the insulation hole and the division hole are formed in a stepped shape by semi-etching, a required minimum height is obtained and a molding resin and a physical and chemical adhesion effect of the lead frame and the insulation body and a moisture-absorption extension caused thereby and an interception effect can be maximized.

[69] The insulation body 130 is formed around the chip bonding pad 112. The insulation body 130 fixes the lead 116 and has a cavity 140 in its center. The cavity 140 is used to reflect and condense light emitted from the light emitting diode chip 115

and a light emitting window 143 filled with a transparent material is formed inside the cavity 140. The light emitting window 143 protects the light emitting diode chip 115 and allows light emitted from the light emitting diode chip 135 to pass and to be radiated to the outside.

[70] The heat sink plate 120 extends to and protrudes from the outside of the insulation body 130. In the present invention, the heat sink plate 120 is integrated into the chip bonding pad 112 and the insulation body 130 and the heat sink plate 120 are combined with each other through the stepped division hole 118 so that the possibility of moisture-absorption or exfoliation can be remarkably reduced. Thus, the heat sink plate 120 can extend to the circumference of the insulation body 130. Referring to FIG. 5A, when the insulation body 130 has a circular shape, the heat sink plate 120 extends to the entire circumference of the insulation body 130. In this way, the heat sink plate 120 can be formed over the entire circumference of the insulation body 130. However, even though the heat sink plate 120 does not extend to the entire circumference of the insulation body 130, a contact surface between the insulation body 130 and the heat sink plate 120 can be adjusted in consideration of a proper heat dissipation performance compared to the entire size of the package. The heat sink plate 120 may extend to occupy more than a fourth part of the entire circumference of the insulation body 130 so as to guarantee the heat dissipation performance.

[71] When the insulation body 130 has a rectangular shape, for example, the heat sink plate 120 is formed to have a size that occupies more than at least one side surface of the insulation body 130. FIG. 6 illustrates the case where an insulation body 130' is deformed in a rectangular shape from a circular shape in the package illustrated in FIG. 5A. Here, the case where the heat sink plate 120 is formed over the entire circumference of the insulation body 130' having a rectangular shape is shown. However, even when a relatively small amount of heat may be dissipated or an area for installing a heat sink plate is limited due to a spatial problem of the heat sink plate, the heat sink plate may be formed to have at least one side surface of the insulation body having a rectangular shape. In this way, since, in the present invention, the heat sink plate can be formed to occupy at least one side surface of the insulation body having a rectangular shape, a problem related to heat dissipation of a high-output light emitting diode package can be solved.

[72] Through the above structure, heat generated in the light emitting diode chip 115 is effectively dissipated through the heat sink plate 120 or 120' having a large area.

[73] The light emitting diode chip 115 is electrically connected to the lead 116 via the wire bonding 117, and the lead 116 forms a bottom surface having the same level as the chip bonding pad 112 and the heat sink plate 120. Here, the lead 116 is formed from the chip bonding pad 112, the heat sink plate 120, and one unit lead frame 110

and may form a bottom surface having the same level as the chip bonding pad 112 and the heat sink plate 120 without the necessity of mechanical folding.

[74] A light emitting diode chip package according to another embodiment of the present invention will now be described.

[75] FIG. 7A is a plane view of a lead frame 200 of a light emitting diode package, and FIG. 7B is a bottom surface view of FIG. 7A. The lead frame 200 includes unit lead frames 210 and is cut along a cut line L, thereby being separated by the unit lead frames 210.

[76] In the current embodiment of the present invention, the chip bonding pad 212 and the heat sink plate 220 are formed in a single unit. At this time, the chip bonding pad 212 is eccentric with the heat sink plate 220. For example, the chip bonding pad 212 may be eccentric with one side surface of the heat sink plate 220 or may be placed at an edge thereof.

[77] FIGS. 7A and 7B illustrate the case where the heat sink plate 220 has a rectangular shape and the chip bonding pad 212 is placed at a corner of the heat sink plate 220 having a rectangular shape. A plurality of through holes 222 are formed in the heat sink plate 220 so as to increase a heat dissipation area, and a combination hole 224 is formed in the heat sink plate 220 for combination with another structure.

[78] The chip bonding pad 212 and the heat sink plate 220 are separated from each other by zones by a plurality of division holes 218, and a lead 216 that is electrically insulated from the chip bonding pad 212 and the heat sink plate 220 by an insulation hole 214 is provided. Referring to FIG. 8, the insulation hole 214 and the division holes 218 include relatively narrower portions 214a and 218a and relatively wider portions 214b and 218b.

[79] FIG. 9A is a plane view of a light emitting diode package in which a plastic resin is injected through the insulation hole 214 and the division holes 218 and the insulation body 230 is formed, FIG. 9B is a bottom surface view of FIG. 9A, and

[80] FIG. 10 is a cross-sectional view taken along line D-D of FIG. 9A. The insulation body 230 surrounds the chip bonding pad 212, a cavity 240 is formed in the center of the insulation body 230, and a light emitting diode chip 215 is mounted inside the cavity 240. Referring to FIG. 10, the light emitting diode chip 215 is electrically connected to the lead 216 via the wire bonding 217, and a light emitting window 243 through which light emitted from the light emitting diode chip 215 passes and is emitted to the outside is formed.

[81] The construction and operation of the current embodiment of the present invention are similar to those of the embodiment illustrated in FIGS. 5A through 5C except that the insulation body 230 is eccentric with the heat sink plate 220, and thus, a detailed description thereof will be omitted.

[82] When the insulation body 230 is placed at a corner of the heat sink plate 220, this may be advantageous when a plurality of light emitting diode packages are arranged. As illustrated in FIG. 11, a plurality of light emitting diode packages for emitting light having different wavelengths are regularly arranged so that a chip of each of the light emitting diode packages is located in the center and each heat sink plate is placed towards the outside. Thus, a heat dissipation effect can be maximized and light having different wavelengths can be emitted to be adjacent to one another as possible.

[83] For example, a first light emitting diode package 250R for emitting red light, a second light emitting diode package $250G_1$ for emitting first green light, a third light emitting diode package $250G_2$ for emitting second green light, and a fourth light emitting diode package 250B for emitting blue light are arranged so that each light emitting chip is located in the center. Each chip for emitting light having different wavelengths are arranged to be adjacent to one another to be advantageous for color mixture, and each heat sink plate is directed towards the outside so that heat dissipation can be effectively performed.

[84] A multi-light emitting diode package module according to an embodiment of the present invention will now be described.

[85] Referring to FIG. 12A, in the multi-light emitting diode package module, a chip bonding pad 312 on which a light emitting diode chip 315 is to be mounted is formed on a heat sink plate 320 having a large area at predetermined intervals, and first and second leads 316a and 316b for being electrically connected to the light emitting diode chip 315 and supplying power thereto are formed to be insulated from the chip bonding pad 312 and the heat sink plate 320.

[86] An insulation body 330 is formed of a plastic resin around the chip bonding pad 312. FIG. 12B illustrates a bottom surface of the multi-light emitting diode package module of FIG. 12A. The heat sink plate 320 and the chip bonding pad 312 are formed in a single unit and are separated from each other by zones by a plurality of division holes 318. The first and second leads 316a and 316b are electrically insulated from the heat sink plate 320 and the chip bonding pad 312 by an insulation hole 314. The first and second leads 316a and 316b are electrically connected to an anode and a cathode of the light emitting diode chip 315 via a wire bonding 317. When the leads 316a and 316b placed at the anode and the cathode of the light emitting diode chip 315 extend to one side surface of the module, it is suitable for mounting the module on its side. Here, the chip bonding pad and the heat sink plate are insulated from a lead terminal connected to the two electrodes of the light emitting diode chip and do not have electrical polarity.

[87] The first and second leads 316a and 316b may be formed from one lead frame together with the chip bonding pad 312 and the heat sink plate 320. In this case, the

first and second leads 316a and 316b may be formed so that their bottom surface has the same level as the chip bonding pad 312 and the heat sink plate 320 without the need of mechanical folding.

[88] A plurality of through holes 322 are formed in the heat sink plate 320 so that an exhaust surface and a solder surface are increased, soldering quality is improved, a heat dissipation surface area is increased and a heat dissipation effect is improved. Reference numeral 324 denotes a combination hole.

[89] In the package module according to the present invention, a plurality of light emitting diode packages are arranged on one large-area heat sink plate 320 so that a space between packages is used as a heat dissipation space and a heat dissipation effect is improved. Furthermore, the multi-light emitting diode package is modulated so that productivity can be increased and the multi-light emitting diode package can be conveniently used. In the present invention, the chip bonding pad and the heat sink plate are formed in a single unit and a plurality of division holes through which combination with the insulation body can be strongly performed so that an area for installing the heat sink plate need not to be limited due to moisture-absorption and exfoliation. Thus, the module can be configured by arranging a plurality of chip packages are arranged on one large-area heat sink plate. When the light emitting diode packages are arranged, a plurality of chips for emitting light having different wavelengths are properly arranged so that color can be implemented. For example, a red light emitting diode package for emitting red light, a green light emitting diode package for emitting green light, and a blue light emitting diode package for emitting blue light are sequentially and repeatedly arranged, or a red light emitting diode package, a first green light emitting diode package, a second light emitting diode package, and a blue light emitting diode package are sequentially and repeatedly arranged. Here, the first and second green light emitting diodes may be configured by chips having the same wavelength or chips having different wavelengths.

[90] Light-weight, thin, short and small-size are important in a general semiconductor package. However, a light emitting diode device does not output an electrical signal but outputs light and thus is used in illumination systems or backlights for a large-scale LCD having a relatively larger installation space compared to electronic products for emphasizing small-size. In this regard, solving of heat dissipation problems is further emphasized than light-weight, thin, short and small-size so that the package module according to the present invention can be usefully used in the light emitting diode device.

[91] FIGS. 13A and 13B illustrate another modified example of the multi-light emitting diode package module illustrated in FIG. 12A. A chip boding pad 412 on which a light emitting diode chip 415 is to be mounted is formed on a heat sink plate 420 having a

large area at predetermined intervals, and first and second leads 416a and 416b are formed to be insulated from the chip bonding pad 412 and the heat sink plate 420 in the state where the chip bonding pad 412 is placed therebetween. An insulation body 430 is formed of a plastic resin around the chip boding pad 412. A plurality of through holes 422 and a combination hole 424 are formed in the heat sink plate 420.

[92] The package module illustrated in FIGS. 13A and 13B are different from the package module illustrated in FIGS. 12A and 12B in the construction of first and second leads. Although not shown, when the package module according to the present invention is manufactured, an insulation hole and division holes respectively include relatively narrower portions and relatively wider portions, as illustrated in FIG. 4. As such, a combination area of the insulation body and the chip bonding pad and the heat sink plate is increased so that a combination force can be increased and structural reliability of moisture-absorption and exfoliation can be improved.

[93] According to the present invention, the chip bonding pad and the heat sink plate are formed in a single unit so that a heat dissipation problem can be solved, and a plurality of light emitting diode packages are arranged on one large-area heat sink plate and thus can be modularized.

[94] FIG. 14 illustrates the case where a light emitting diode package 450 is mounted on a printed circuit board (PCB) 460. A path E on which operating heat of the light emitting diode chip 455 is conducted and is emitted is shown in FIG. 14. In the light emitting diode package 450, the chip bonding pad, the large-area heat sink plate and the bottom surface of the lead are directly soldered on the PCB 460 and a PCB in which a copper plate is stacked on both sides of a resin is used as the PCB 460. In the prior art, an expensive heat dissipation PCB is used for heat dissipation. However, in the present invention, a general PCB having a copper plate-stacked structure may be used as the PCB 460.

[95] The heat dissipation PCB is formed by attaching a thin PCB on an aluminum plate using a heat conductive adhesive. When the heat conductive adhesive is used, thermal resistance is larger than in the copper plate-stacked structure. In a general copper plate PCB, since heat is effectively transmitted to a copper foil pattern formed on its rear side in a large area as possible through a plurality of plated through holes 463, an improved heat conduction path is formed in the general copper plate-stacked PCB. When the plurality of plated through holes are added to the copper plate-stacked PCB and a heat dissipation pattern is made broad, the general copper plate-stacked PCB has smaller thermal resistance that in the expensive heat dissipation PCB and heat dissipation can be effectively performed.

Industrial Applicability

[96] In the light emitting diode package according to the present invention, a heat sink

plate is formed to have a large area as possible so as to maximize a heat dissipation performance. Furthermore, a plurality of light emitting diode packages are arranged on one large-area heat sink plate and can be modularized.

Claims

[1] A light emitting diode package comprising:
a chip bonding pad on which a light emitting diode chip is to be mounted;
at least one lead electrically connected to the light emitting diode chip and insulated from the chip bonding pad;
an insulation body formed around the chip bonding pad, fixing the lead and having a light emitting window through which light emitted from the light emitting diode chip passes;
a heat sink plate integrated into the chip bonding pad, protruding from an outside of the insulation body and dissipating operating heat of the light emitting diode chip; and
a plurality of division holes which are formed between the chip bonding pad and the heat sink plate and have a stepped shape and into which a resin is injected when the insulation body is formed,
wherein the heat sink plate occupies more than a fourth part of the entire outer circumference of the insulation body.

[2] The light emitting diode package of claim 1, wherein the insulation body has a circular shape.

[3] The light emitting diode package of claim 1, wherein the division holes that are closer to the insulation body have a smaller width than the division holes that are distant from the insulation body.

[4] A light emitting diode package comprising:
a chip bonding pad on which a light emitting diode chip is to be mounted;
at least one lead electrically connected to the light emitting diode chip and insulated from the chip bonding pad;
an insulation body formed around the chip bonding pad, fixing the lead and having a light emitting window through which light emitted from the light emitting diode chip passes;
a heat sink plate integrated into the chip bonding pad, protruding from an outside of the insulation body and dissipating operating heat of the light emitting diode chip; and
a plurality of division holes which are formed between the chip bonding pad and the heat sink plate and have a stepped shape and into which a resin is injected when the insulation body is formed,
wherein the insulation body has a rectangular shape and the heat sink plate occupies at least one side surface of a rectangular circumference of the insulation body.

[5] The light emitting diode package of claim 4, whereinthe division holes that are closer to the insulation body have a smaller width than the division holes that are distant from the insulation body.

[6] The light emitting diode package of any one of claims 1 through 5, wherein the lead forms a bottom surface having the same level as the chip bonding pad and the heat sink plate.

[7] The light emitting diode package of any one of claims 1 through 5, wherein the lead includes two-electrode leads, each of the leads being connected to an anode and a cathode of the light emitting diode chip, and the chip bonding pad and the heat sink plate are insulated from the light emitting diode chip.

[8] The light emitting diode package of any one of claims 1 through 5, wherein the lead is electrically connected to one electrode of the light emitting diode chip and the chip bonding pad and the heat sink plate are electrically connected to the other electrode of the light emitting diode chip.

[9] The light emitting diode package of any one of claims 1 through 5, wherein the insulation body is formed in a center of the heat sink plate.

[10] The light emitting diode package of any one of claims 1 through 5, wherein the insulation body is formed to be eccentric with the heat sink plate.

[11] The light emitting diode package of any one of claims 1 through 5, wherein the heat sink plate has a rectangular shape and the insulation body is formed at an edge or a corner of the heat sink plate.

[12] The light emitting diode package of any one of claims 1 through 5, wherein the heat sink plate comprises a plurality of through holes so as to increase a heat dissipation surface area and to easily perform soldering.

[13] The light emitting diode package of any one of claims 1 through 5, wherein the chip bonding pad, the heat sink plate, and the lead are formed from one lead frame.

[14] A multi-light emitting diode package module comprising:
a large-area heat sink plate dissipating operating heat of a light emitting diode chip; and
a plurality of light emitting diode packages arranged on the heat sink plate to be separated from one another by a predetermined distance,
wherein each of the light emitting diode packages comprises:
a chip bonding pad which is integrated into the heat sink plate and which is separated from the heat sink plate by zones by a plurality of division holes having a stepped shape and on which the light emitting diode chip is to be mounted;
at least one lead electrically connected to the light emitting diode chip and

insulated from the chip bonding pad; and

an insulation body formed around the chip bonding pad, fixing the lead and having a light emitting window through which light emitted from the light emitting diode chip pass.

[15] The multi-light emitting diode package module of claim 14, wherein the lead forms a bottom surface having the same level as the chip bonding pad and the heat sink plate.

[16] The multi-light emitting diode package module of claim 14 or 15, wherein the lead includes two-electrode leads, each of the leads being connected to an anode and a cathode of the light emitting diode chip, and the chip bonding pad and the heat sink plate are insulated from the light emitting diode chip.

[17] The multi-light emitting diode package module of claim 14 or 15, wherein the lead is electrically connected to one electrode of the light emitting diode chip and the chip bonding pad and the heat sink plate are electrically connected to the other electrode of the light emitting diode chip.

[18] The multi-light emitting diode package module of claim 14 or 15, wherein the heat sink plate comprises a plurality of through holes so as to increase a heat dissipation area and to easily perform soldering.

[19] The multi-light emitting diode package module of claim 14 or 15, wherein the chip bonding pad, the heat sink plate and the lead are formed from one lead frame.

[20] The multi-light emitting diode package module of claim 14 or 15, wherein the division holes that are closer to the insulation body have a smaller width than the division holes that are distant from the insulation body.

FIG. 1

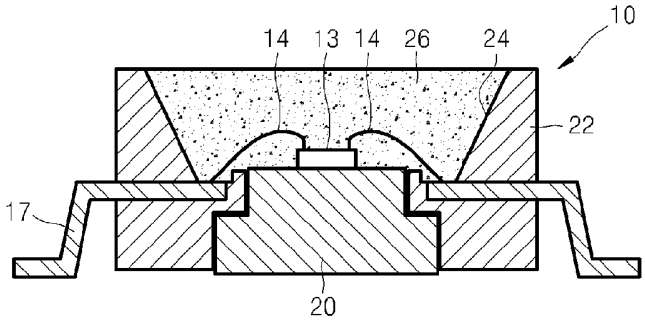


FIG. 2

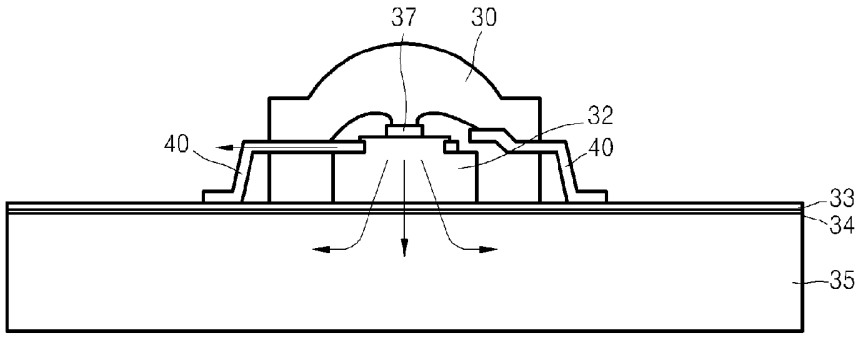


FIG. 3A

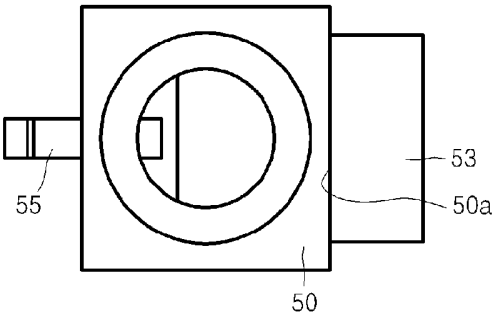


FIG. 3B

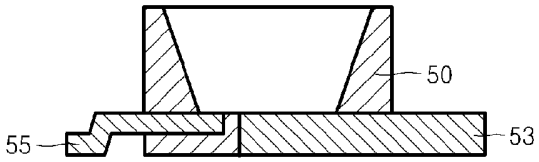


FIG. 3C

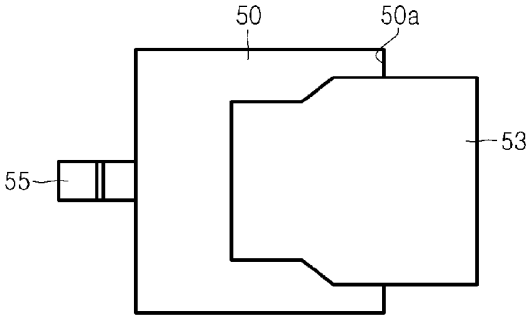


FIG. 4A

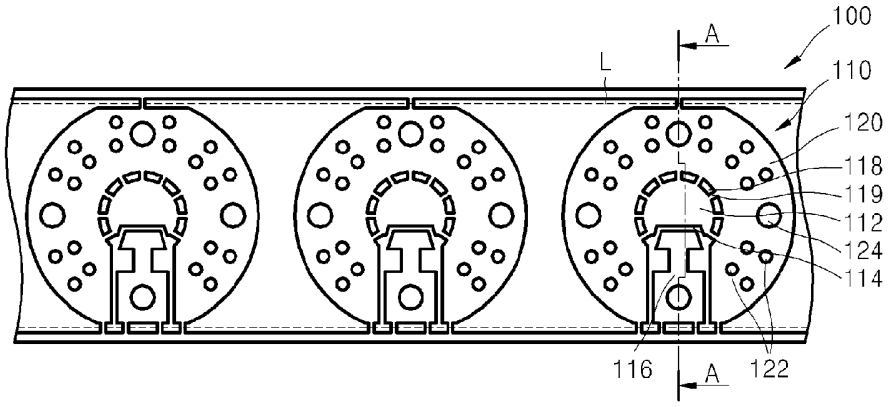


FIG. 4B

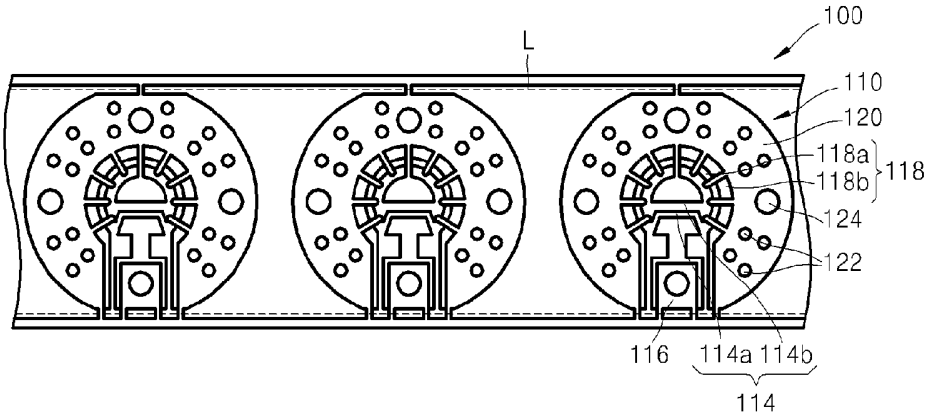


FIG. 4C

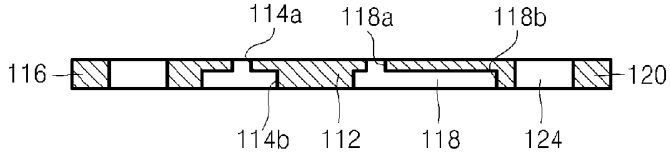


FIG. 5A

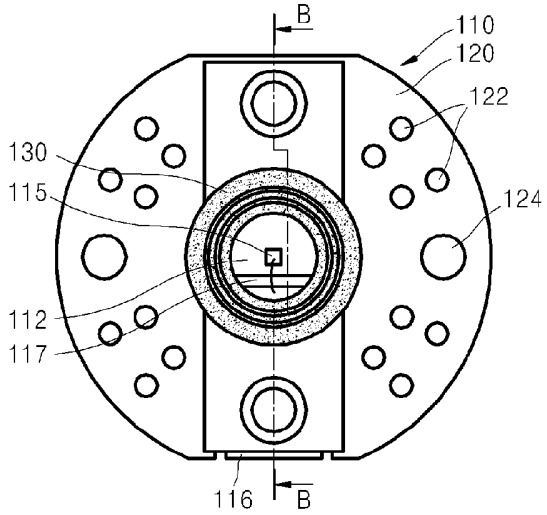


FIG. 5B

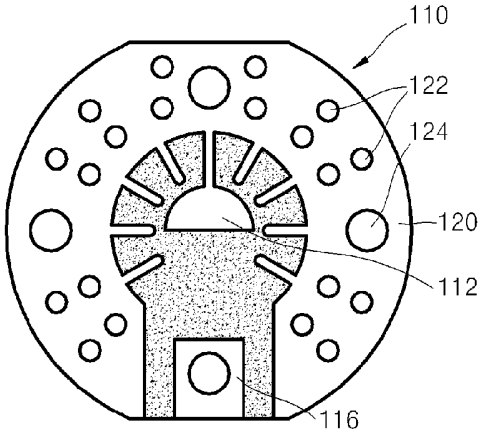
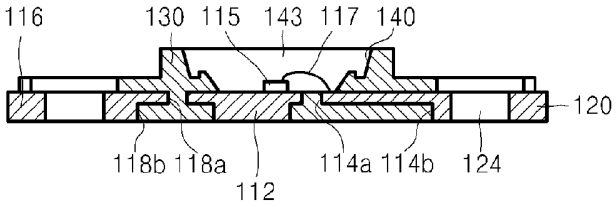


FIG. 5C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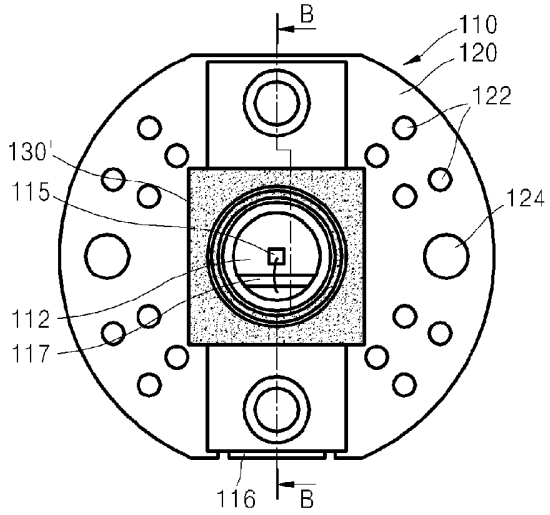
118b
118a
112
114a
114b
124

FIG. 6


B
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116
B

FIG. 7A

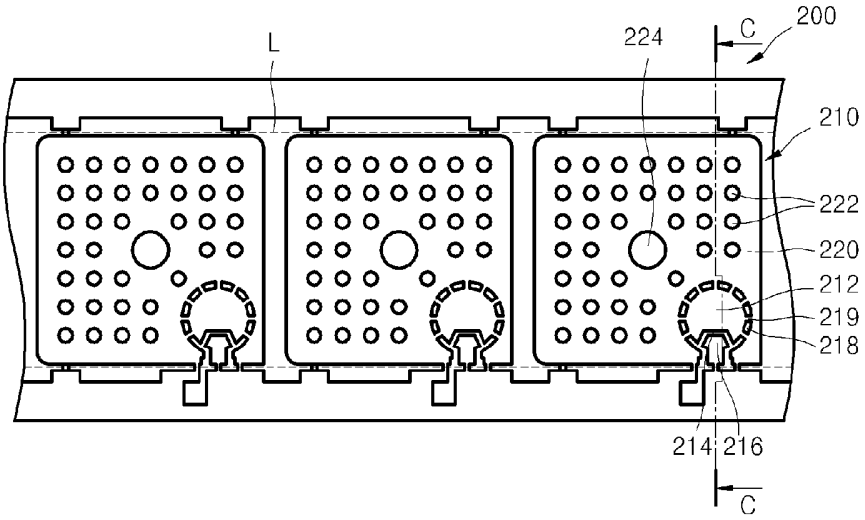


FIG. 7B

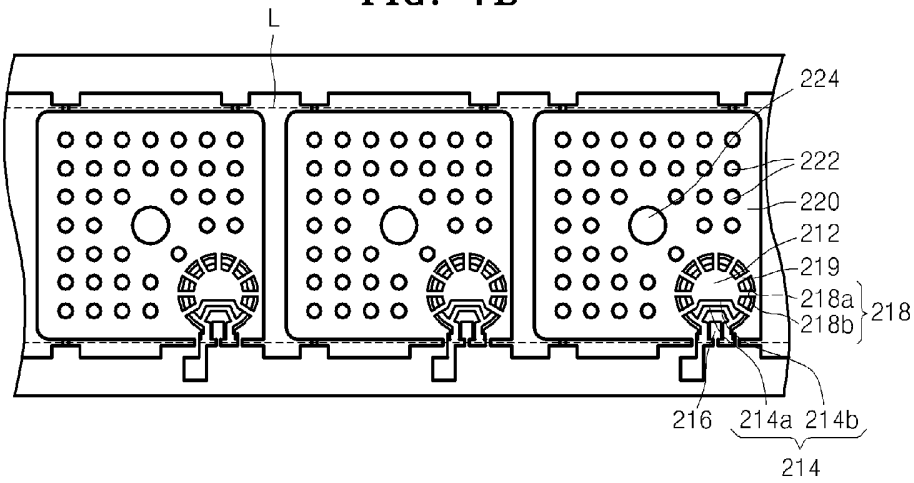


FIG. 8

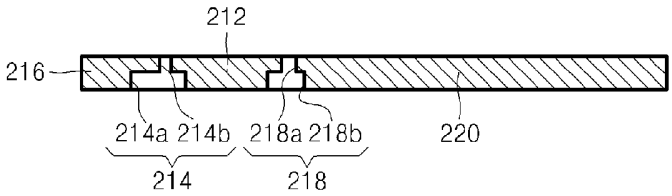


FIG. 9A

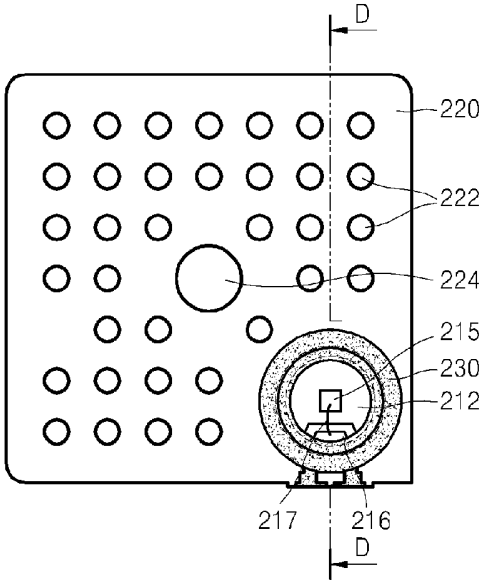


FIG. 9B

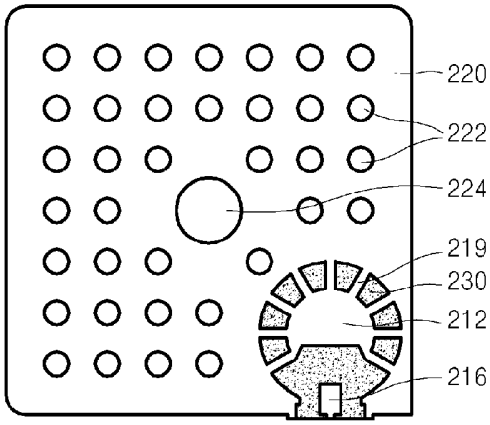


FIG. 10

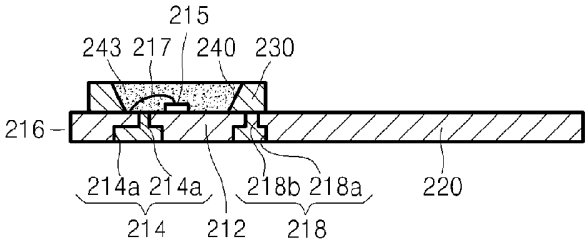


FIG. 11

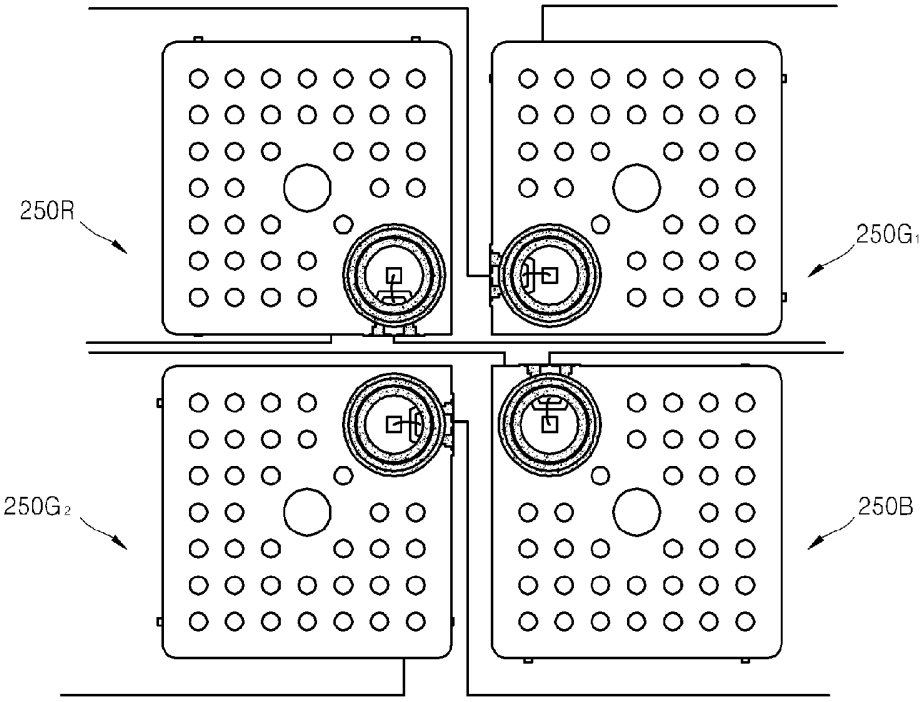


FIG. 12A

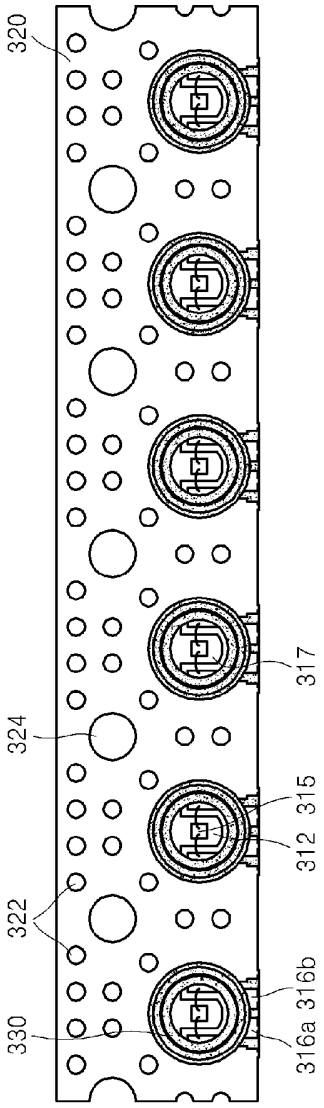


FIG. 12B

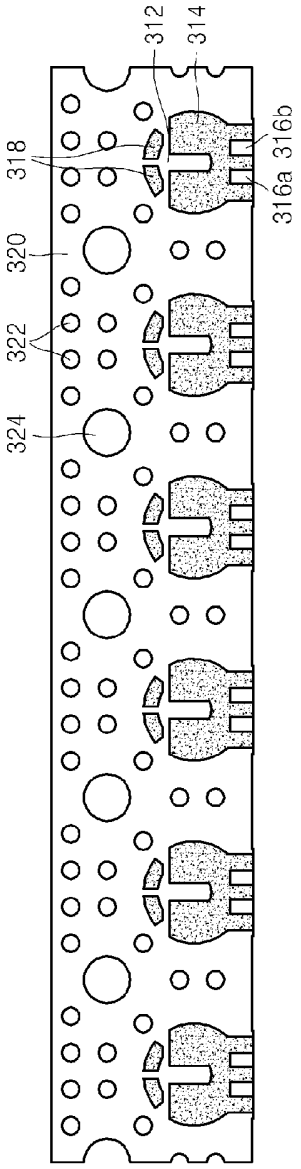


FIG. 13A

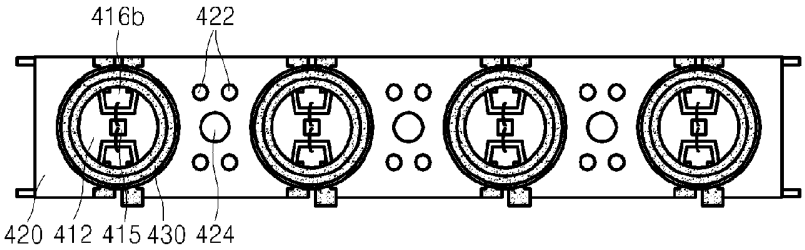


FIG. 13B

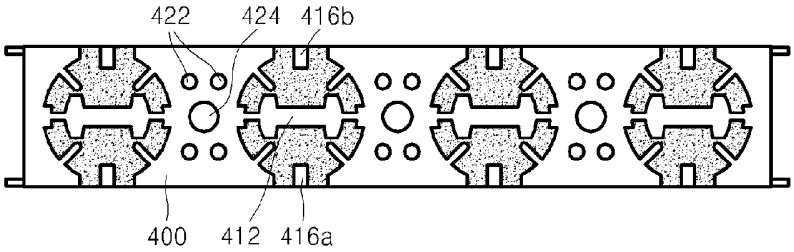
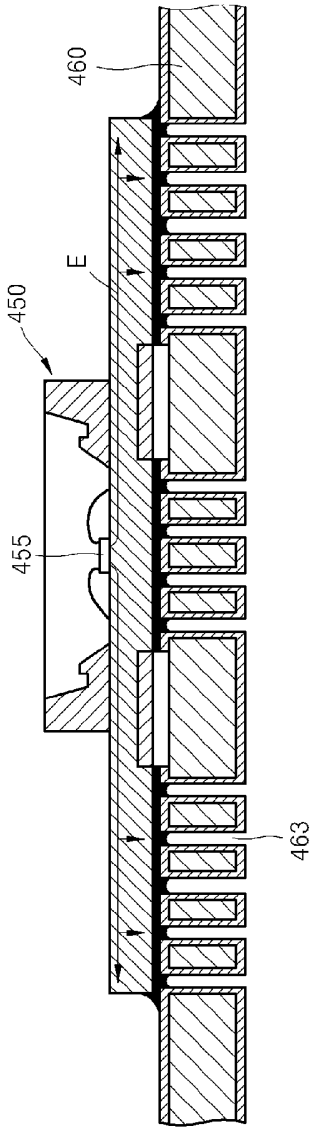


FIG. 14



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2006/001878

A. CLASSIFICATION OF SUBJECT MATTER

H01L 33/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC8 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applictions for Utility models since 1975
Japanese Utility models and application for Utility models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)
eKIPASS(KPA, PAJ, FPD, USPATFULL) in KIPO

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 06-053389 (Nec Co.) 25 Feb 1994 See Figure 1; Abstract	1
A	JP 11-017231 (Sharp Co..) 22 Jan 1999 See the whole document	1
A	JP 04-022159 (Hitachi Ltd., Hitachi Micro Comput. Eng. Ltd,) 16 Mar 1999 see Claim 1; Figure 1	1
A	US 2004/0126913 (Loh) 1 Jul 2004 See Claim 1; Figure 2	1
A	KR 10-2005-35638 (Bionics Co. Ltd.,) 19 Apr 2005 See the whole document	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 AUGUST 2006 (10.08.2006)	**11 AUGUST 2006 (11.08.2006)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer LEE, Jin Hong Telephone No. 82-42-481-8509

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR2006/001878

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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KR1020050035638	19.04.2005	None	