

LIGHT EMITTING DIODE PACKAGES AND THEIR USES

Field of Invention

[001] The present invention relates to light emitting diode (LED) packages. It also relates to LED light sources for illuminated panels and display boards.

Background

[002] Semiconductor light emitting diodes (LEDs) consume less electric power than conventional incandescent and fluorescent lamps. LEDs last longer, are compact and can be installed in smaller or thinner lighting apparatuses, such as, advertising panels. With higher awareness to reduce carbon footprint, LED light sources are now preferred.

[003] Conventional LED packages are provided with dual leads or for surface mounting. For example, US Patent No. 6,712,486, assigned to Permlight Products, Inc., describes a lighting module that is made up of a serial array of LEDs. Each LED has two conventional leads that are soldered to separate copper plates disposed on separate sides of a circuit board such that light from the LEDs is coplanar with the circuit board. Through holes are formed through the circuit board and rivets inserted through the holes hold the circuit board onto a heat conduction member. The lighting module is used in a lighting apparatus that is adapted to be installed on the side of a row of theater seats and adapted to illuminate an aisle next to the theater seats. In another example, US Patent No. 7,111,964, assigned to Toyoda Gosei Co., Ltd., describes a lens-type LED package that is surface bonded to a top surface of a wiring board.

[004] US Patent No. 6,491,412, assigned to Everbrite, Inc., describes an illuminated sign with LEDs as light sources. The LEDs are oriented to shine on a rear surface of the illuminated sign. The rear and side surfaces are reflective but the front face is translucent. Light from the LEDs are diffusively reflected off the rear and side surfaces and is outputted through the front surface. The LEDs are mountable on a surface, such as a substrate or support and are interconnected by supply and ground lines.

[005] US Patent No. 6,705,033, issued to Greene, describes an LED-illuminated outdoor sign. The sign is an assembly of a front, centre and rear panels in a face-to-face manner. The centre panel is opaque whilst at least the front panel is transparent. Letters in the sign spelling out the street name, for example, are cut on the inside surface of the front panel. Linear arrays of LEDs are arranged along the top and bottom edges of the front panel so that light rays from the LEDs are transmitted into the body of the front panel through its thickness. The cut edges of the letters refract some of the light rays and the letters become visible.

[006] FIG.1A shows a sectional elevation of a known LED dual leads package 10 used for illuminating a display panel. FIG. 1B shows a sectional elevation of a known LED surface mount package 10a used for illuminating a display panel. The LED package 10 comprises a housing 12 that encloses an LED module 14. The LED module 14 includes an anode, a cathode and a light emitting element that are sealed within an encapsulant. The anode and cathode extend out of the encapsulant as an anode terminal 20 and a cathode terminal 24. In FIG. 1B, the LED package 10a comprises a light emitting element 15 with anode 20 and cathode 24 terminals. As shown in FIGs. 1A and 1B, these terminals 20, 24 are connected respectively to an external anode contact element 21 and an external cathode contact element 25. The two external contact elements 21, 25 are configured on the housing 12 for external power connection to the LED package 10, 10a. The LED packages 10, 10a are shown surface-mounted on an insulating panel 30. The insulating panel 30 has two separate conducting lines 32, 34, which are spaced apart by a gap 36. The two external contact elements 21, 25 are separately connected to the two conducting lines 32, 34. A direct current voltage source (not shown in the figure) supplies power to light up the LED package 10, 10a via the two conducting lines 32, 34. A front panel 40 is mounted over the LED package 10, 10a in face relation with the insulating panel 30 so that light emitted from the LED package 10, 10a is transmitted through the front panel 40. The conducting lines 32, 34 may be formed by patterning a continuous conducting layer on the insulating panel 30 by means of cutting, etching, etc. Such processes of cutting or etching are tedious and expensive. Besides, such processes require precision control for maintaining specified resistance values of the conducting lines 32, 34 to ensure consistent lighting intensity of the LED packages 10, 10a that are connected in series or parallel.

[007] It can thus be seen that there exists a need for new LED packages that can overcome the disadvantages of patterning a wiring board and forming the power supply lines. Desirably, these new LED packages are suitable for mounting inside double-side display panels.

Summary

[008] The following presents a simplified summary to provide a basic understanding of the present invention. This summary is not an extensive overview of the invention, and is not intended to identify key features of the invention. Rather, it is to present some of the inventive concepts of this invention in a generalised form as a prelude to the detailed description that is to follow.

[009] In the present invention, LED packages in the form of button, ring, winged or surface mount configurations are described and illustrated. These LED packages is useful for flat panel lighting assembly, such as signs or advertising boards. Such panel lighting may also be used for indoor and outdoor decoration, especially with LEDs of different colours and projection angles to give more creative use of light from LEDs.

[0010] In one embodiment, the present invention provides a light emitting diode (LED) package comprising: a light emitting element and its anode and cathode terminals; a housing moulding at least part of said light emitting element, anode and cathode terminals; and two contact elements supported by said housing for power lead-in to said light emitting element, wherein said two contact elements define two substantially planar but spaced apart contact planes.

[0011] In one embodiment of the LED package, the housing is disk-shaped. The housing has a profile that is round, oval, polygonal, star, floral, alphabet, numeral or any combination thereof. In another embodiment, the contact element(s) comprises a leaf, arched-shaped, dome-shaped or coiled spring.

[0012] In another embodiment, the present invention provides a LED-illuminated panels assembly comprising: two spaced apart panels arranged in a face-to-face relation, wherein

each of two inside surfaces of said panel assembly has a transparent but electrically conductive layer; and a LED package according to any one of claims 1-16 being sandwiched between said two spaced apart panels, so that a DC power supply, connectable to said electrically conductive layers, delivers electric power to light up said light emitting element.

[0013] In yet another embodiment, the present invention provides a LED-illuminated panels assembly comprising: two spaced apart panels arranged in a face-to-face relation, wherein each of two inside surfaces of said panel assembly has a transparent but electrically conductive layer; a LED package according to any one of claims 1-11 or 16 being sandwiched between said two spaced apart panels; and an electrically conductive ring disposed between at least one of said contact element and associated said electrically conductive layer, so that a DC power supply, connectable to said electrically conductive layers, delivers electric power to light up said light emitting element.

[0014] In another embodiment, the present invention provides a LED-illuminated panels assembly comprising: two spaced apart panels arranged in a face-to-face relation, wherein each of two inside surfaces of said panel assembly has a transparent but electrically conductive layer; a LED package according to any one of claims 9-11 being sandwiched between said two spaced apart panels; and a bolt, disposed in holes formed through said two spaced apart panels that are also in register with said hole through said LED package, cooperating with a nut is operable to clamp said panel assembly together.

[0015] In an embodiment, the transparent but electrically conductive layer comprises a transparent conductive oxide layer and the panels comprise transparent glass or plastic.

Brief Description of the Drawings

[0016] This invention will be described by way of non-limiting embodiments of the present invention, with reference to the accompanying drawings, in which:

[0017] FIGs. 1A and 1B illustrate surface mounting of two known types of LEDs inside a double-side panel display board;

[0018] FIG. 2A illustrates a perspective view of a LED button package according to an embodiment of the present invention; and FIGs. 2B and 2B1 illustrate two types of the LED button package shown in FIG. 2A;

[0019] FIG. 2C illustrates a sectional elevation of a button package having two LEDs according to another embodiment of the present invention;

[0020] FIG. 2D illustrates a LED button package with a leaf spring according to another embodiment of the present invention;

[0021] FIG. 2E illustrates a LED button package with LEDs disposed on a peripheral surface according to another embodiment of the present invention;

[0022] FIG. 2F illustrates a LED button package with a arched-shaped spring according to another embodiment of the present invention, whilst FIG. 2F1 illustrates a sectional elevation;

[0023] FIG. 2G illustrates a LED button package with a coiled spring according to another embodiment of the present invention;

[0024] FIG. 3 illustrates perspective view of a LED ring package according to another embodiment of the present invention, whilst FIG. 3A illustrates an exploded view; and FIG. 3B illustrates a side elevation of the LED housing shown in FIG. 3A;

[0025] FIGs. 3C and 3C1 illustrate sectional views of one type of LED ring package shown in FIG. 3, whilst FIG. 3C2 illustrates a sectional view of another type of LED ring package;

[0026] FIG. 3D illustrates a LED ring package with a leaf spring according to another embodiment of the present invention;

[0027] FIG. 3E illustrates a LED ring package having two rows of LEDs according to another embodiment of the present invention ;

[0028] FIG. 3F illustrates a side view of a LED ring package with three rows of LEDs;

[0029] FIG. 3G illustrates a LED ring package having a mounting nut; and FIG. 3H illustrates a section elevation of the LED ring package shown in FIG. 3G;

[0030] FIGs. 4A-4C illustrate a quad-wing LED package according to another embodiment of the present invention;

[0031] FIG. 5 illustrates a surface mount LED package according to another embodiment of the present invention; and

[0032] FIGs. 6A-6C illustrate double-side display panels using the LED packages shown in the above figures, whilst FIG. 6D illustrates the LED ring package for use with a conductive ring and FIG. 6E illustrates a use of the button package for displaying alphabet A.

Detailed Description

[0033] One or more specific and alternative embodiments of the present invention will now be described with reference to the attached drawings. It shall be apparent to one skilled in the art, however, that this invention may be practised without such specific details. Some of the details may not be described at length so as not to obscure the invention. For ease of reference, common reference numerals or series of numerals will be used throughout the figures when referring to the same or similar features common to the figures.

[0034] FIG. 2A shows a perspective view of a LED button package 100 according to an embodiment of the present invention. FIG. 2B shows a sectional elevation of the LED button package 100 configured with a dual leads LED 14, whilst FIG. 2B1 shows that configured with a surface mount LED 15. As shown in FIGs. 2A, 2B and 2B1, the LED

button package 100 contains an LED module 14 or light emitting element 15 being encapsulated in a housing 112. The housing 112 is disk-shaped of a thickness T with two opposite faces that are substantially parallel. The housing 112 may be made of a resin moulding, such as, epoxy. As shown in FIG. 2B, the housing at a front end of the LED module 14, ie. region 113, may be devoid of the housing material. An upper annular contact element 125, that is, having an aperture 127, is planar and is disposed on the face of the housing 112 in relation to the direction of light emitting from the LED module 14 or light emitting element 15; the other face of the housing 112 is disposed a lower, planar contact element 121. Either of the contact elements 121, 125 can be configured the anode or cathode depending on the polarity of the terminal 20, 24 to which it is connected to.

[0035] In one embodiment of the LED button package shown in FIGs. 2A, 2B and 2B1, the lower contact element 121 is slightly bigger than the upper contact element 125 and its polarity may be predetermined. In another embodiment, the lower and upper contact elements 121, 125 are of the same dimension but a dot or a mark (not shown in the figure) is formed on one of the contact elements to indicate its polarity. Accordingly, the present invention provides the LED button package 100 with two substantially parallel, opposite planar contact elements 121, 125 for power lead in to the LED module 14 or light emitting element 15. In use, light emitting from the LED module 14 or light emitting element 15 radiates out of the housing 112 through the aperture 127.

[0036] The face of the housing 112 is shown to be round in FIG. 2A; however, the face of the housing 112 can be of other shapes or outlines, such as, oval, polygonal, star, floral petal, alphabet, numeral, and so on. In one embodiment of the contact element 125, the aperture 127 has a shape that follows the shape of the face of the housing 112; in another embodiment, the shape of the aperture 127 is inconsistent with the shape of the face of the housing 112. In one embodiment, the housing 112 is made of an optically transparent material; in another embodiment, the housing 112 is made of a translucent material but the region 113 surrounding the front end of the LED module 14 is made of an optically transparent material. In addition, the region 113 helps to direct light from the LED module 14 through the aperture 127.

[0037] FIG. 2C shows a sectional view of a LED button package 100a according to another embodiment of the present invention. As shown in FIG. 2C, the LED button package 100a is made up of a housing 112a of disk-shaped, like the above embodiment 100 but with both contact elements 121a, 125, each having an aperture 127. The apertures 127 on opposite contact elements 121a, 125 may be of the same shape or different shapes. In this LED button package 100a, there are two light emitting elements 15 being configured back to back so that light emitting from the light emitting elements 15 radiates out of both faces of the package 100a through the associated aperture 127. In another embodiment (not shown), the LED button package 100a is configured with the LED modules 14.

[0038] FIG. 2D shows a LED button package 100b according to another embodiment of the present invention. As shown in FIG. 2D, the LED button package 100b is similar to package 100 except that an upper annular contact element 125a is formed with a leaf spring 128. The leaf spring 128 may be formed integrally with the contact element 125a by cutting or shearing a portion of the contact element 125a and bending it out of the plane with the remaining portion of the contact element 125a. As will be appreciated later, the leaf spring 128 allows the LED button package 100b to be installed between two display panels 510 that are substantially parallel yet maintaining reliable electrical contact with conductive layers 520 disposed on inside surfaces of the two spaced apart display panel (as seen in FIG. 6A). Additionally or alternatively, in another embodiment (not shown in the figures), the leaf spring 128 is provided on the lower contact element 121.

[0039] FIG. 2E shows a perspective view of a LED button package 100c according to another embodiment of the present invention. As shown in FIG. 2E, the LED button package 100c is similar in outline as the above embodiments but the light emitting elements 15 are disposed on the cylindrical surface of a housing 112c so that light radiates radially from the button package 100c. In FIG. 2E, leaf spring 128 is shown extending from an upper contact element 125c.

[0040] FIG. 2F shows a perspective view of a LED button package 100d according to another embodiment of the present invention. LED button package 100d is shown to have a square outline for illustration purposes. FIG. 2F1 shows a sectional view of the LED button package 100d. As shown, LED button package 100d has two upper contact elements 125d

disposed on either side of the light emitting element 15, whilst the lower contact element 121b is arched-shaped. The arched-shaped lower contact element 121b is thin and resilient, and it acts like a spring to compensate for parallelism run-out between two display panels 510 when the LED button package 100d is installed. In another embodiment (not shown), the LED button package 100d is round in outline, the upper electrode 125d is annular and the lower contact element is dome-shaped.

[0041] FIG. 2G shows a LED button package 100e according to another embodiment of the present invention. As shown in FIG. 2G, the LED button package 100e is similar to the above button package 100 except that there is a coiled spring 129 mounted below the lower contact element 121. The coiled spring 129 serves similar purposes as the above leaf spring 128, arched-shaped lower contact element 121b or dome-shaped lower contact element.

[0042] FIG. 3 shows a LED ring package 200 according to an embodiment of the present invention. FIG. 3A shows an exploded view of the LED ring package 200. FIG. 3B shows an elevation of abutting ends of a flexible circuit 203 formed around a housing 212 of the ring package 200. As shown in FIGs. 3 and 3A, the LED ring package 200 has the same external shape as the above button package 100c except that there is a centre mounting hole 204 formed through the thickness T of the disk-shaped package. The mounting hole 204 is shaped and dimensioned to receive a bolt or a pin for securing the LED ring package 200 between two display panels (as seen in FIG. 6B). In this embodiment, the light emitting elements 15 are mounted on the flexible circuit 203, which is formed around the housing 212 of the ring package 200. Terminals 20 of the light emitting elements 15 are linked to a common terminal 226, which is then electrically connected to the upper contact element 225 when the LED ring package 200 is assembled. Similarly, terminals 24 of the light emitting elements 15 are linked to a common terminal 222 (as seen in the FIG. 3B), which is then electrically connected to the lower contact element 221. In an embodiment, the flexible circuit 203 has one or more resistors 16 coupled to the light emitting elements 15.

[0043] FIG. 3C shows a sectional view of the LED ring package 200 configured with surface mount LED packages 10a. As shown in FIG. 3C, wires 250, 254 connect the electrodes 21, 25 of the light emitting element 15 to the respective contact elements 221,

225. In one embodiment, the apertures 227 on the upper and lower contact elements 221, 225 are slightly bigger than the centre hole 204; this is to ensure that the upper and lower contact elements 221, 225 are not electrically shorted when a metal bolt is inserted into the centre hole 204 for mounting the ring package 200. FIG. 3C1 shows another type of the LED ring package 200 configured with surface mount LED packages 10a and matching resistors 16.

[0044] FIG. 3C2 shows a sectional view of the LED ring package 200 configured with dual leads LED modules 14. As shown, the electrodes 20, 24 of the LED modules 14 are connected to the respective contact elements 221, 225.

[0045] FIG. 3D shows a LED ring package 200a according to another embodiment of the present invention. As shown in FIG. 3D, the LED ring package 200a is similar to LED ring package 200 except that the contact element 225 is integrally formed with a leaf spring 228. The leaf spring 228 is similar to spring 128 and no further description is provided.

[0046] FIG. 3E shows a LED ring package 200b according to another embodiment of the present invention. As shown in FIG. 3E, the LED ring package 200b is similar to ring package 200 except that there are two rows of light emitting elements 15 disposed on the cylindrical surface of the housing 212. The light emitting elements 15 may be arranged so that light is directed at predetermined angles from the sides of the housing 212. Other embodiments configured with the LED modules 14 are possible.

[0047] FIG. 3F shows a side view of a LED ring package 200c similar to the above package 200a but with three rows of light emitting elements 15. The light emitting elements 15 are configured such that light is directed to radiate all round the cylindrical surface of the housing 212.

[0048] FIG. 3G shows a LED ring package 200d according to another embodiment of the present invention. The LED ring package 200d is similar to the above ring package 200, 200a, 200b, 200c except that the mounting hole 204 is now threaded 205. The threaded mounting hole 205 can be formed right through or threaded in two sections 205a, 205b, as

shown in FIG. 3H. In another embodiment, the threaded hole 205 is provided by embedding a threaded ring 206 in the housing 212.

[0049] FIGs. 4A-4C show views of a LED quad-wing package 300 according to another embodiment of the present invention. As shown in FIGs. 4A-4C, the LED quad-wing package 300 is made up of an LED module 14 and a housing 312, which moulds a lower part of the LED module 14 so that the electrodes 20, 24 (not shown in FIGs. 4A-4C but shown in FIG. 2B) are embedded in the housing 312 and a top portion of the LED module extends above the housing 312. The electrodes 20, 24 are separately connected, through sides of the housing 312, to four wings 350, 354. As shown in FIGs. 4B and 4C, two wings 350 are formed to extend upwardly and the free ends are bent to define an upper contact plane 351. In a similar manner, the other two wings 354 are formed to extend downwardly and the free ends are bent to define a lower contact plane 355. In one embodiment, either of the wings 350, 354 of the LED quad-wing package 300 is predetermined as the anode or cathode. In another embodiment, one or more dummy wings is/are additionally provided so that the package 300 can sit stably, for eg., during installation. The LED quad-wing package 300 shares the same inventive concept as the above embodiments by providing a LED package with two contact planes 351, 355. These contact planes 351, 355 correspond with conductive layers 520 shown in FIGs. 6A and 6B, through which power lead in is conducted via the quad-wings 350, 354 to light up the LED module 14. It is possible to configure another quad-wing package with the above light emitting elements 15.

[0050] FIG. 5 shows a side elevation of a LED surface-mount package 400 according to another embodiment of the present invention. As shown in FIG. 5, a lower part of the LED module 14 is moulded in a housing 412 such that electrodes 20, 24 (not shown in FIG. 5 but shown in FIG. 2B) are separately connected electrically to an upper contact element 425 and a lower contact element 421. The lower and upper contact elements 421, 425 are substantially planar and parallel to each other. In use, these contact elements 421, 425 are disposed in electrical contact with respective conductive layers 520 shown next in FIG. 6A or 6B. In another embodiment, a hollow conductive adaptor 430 is provided to fit over the LED module 14 so that a top of the conductive adaptor 430 defines a contact plane above the top of the LED module 14.

[0051] FIG. 6A shows an installation of the LED button package 100 according to an embodiment of the present invention. For illustration purposes, FIG. 6A is shown with the LED button package 100 sandwiched between two panels 510. These panels 510 may be glass or plastics (such as acrylic, polycarbonate and so on). As seen in FIG. 6A, the inside or opposing faces of the panels 510 are coated with a transparent conductive layer 520, such as transparent conductive oxide (TCO) that is commonly used in liquid crystal display panels. The conductive layer 520 on one panel 510 is defined as the anode whilst the conductive layer 520 on the opposite panel is defined as the cathode. A direct current (DC) power supply (not shown in the figure) is connected accordingly to the anode and cathode conductive layers 520. In use, the lower and/or upper contact elements 121,125 are electrically bonded onto the respective conductive layers 520 with conductive adhesive, such as conductive epoxy, and the DC power supply delivers electric power, say between 5V to 24V through the anode and cathode conductive layers 520 to light up the LED module 14 and/or light emitting elements 15. This method of installation is also useful for the button packages 100a, 100b, 100c, 100d, 100e. An advantage of using the LED button package 100b, 100c is that the leaf spring 128 allows the associated contact element(s) to make reliable electrical contact with the respective conductive layers 520 even when the panels 510 are dimensionally non-planar. In the same manner, the arched-shaped lower contact element 121b and the coiled spring 129 allow the button packages to make reliable electrical contact with the respective conductive layers 520.

[0052] FIG. 6B shows an installation of the LED ring package 200 according to an embodiment of the present invention. As in the previous embodiment, the LED ring package 200 is sandwiched between two panels 510a. As shown in FIG. 6B, there are holes 530 formed in the panels 510a so that the holes 530 on opposite panels are in register with each other. A bolt 540 is inserted through the holes 530 and centre hole 204 of the ring package 200. By tightening the bolt 540 with a nut 542, the contact elements 221, 225 of the LED ring package 200 make electrical contact with the respective conductive layers 520. With the LED ring package 200d having threaded rings 206, two bolts 540 are used to mount the LED ring package 200d between the two panels 510a.

[0053] This method of installation is also used for the LED quad-wing package 300 or surface-mount package 400. For installation of the LED surface-mount package 400, the

hollow conductive adaptor 430 is useful. Without the hollow conductive adaptor 430, a depression will need to be formed on an inside face of the panel 510 to accommodate the protruding LED module 14 so that the upper contact element 425 is in contact with the upper conductive layer 520.

[0054] As discussed above, the display panels are only substantially planar and thus are only substantially parallel. To compensate for dimensional tolerances and deviations, FIG. 6C shows an installation of the LED button package 100 with a conductive ring 560 for contact between the contact element 125 and the upper conductive layer 520. The conductive ring 560 is made of a compliant material, such as, a polymer moulded with electrically conductive particles. In use, the conductive ring 560 is thus able to undergo different degrees of deformations and compensate for the dimensional tolerances and/or deviations without affecting its contact resistance with the conductive layers 520. Whilst not shown, the conductive ring 560 can alternatively or additionally be used between the lower contact element 121 and the lower conductive layer 520.

[0055] FIG. 6D shows the LED ring package 200 with the conductive ring 560 disposed on the upper contact element 225. Installation of this LED ring package 200 is similar to the above embodiment and no further description is provided.

[0056] From the above description, the present invention thus provides a flat panel lighting assembly that may be suitable for signs or advertising boards. Such panel lighting may also be used for indoor and outdoor decoration, especially with LEDs of different colours and projection angles to give more creative use of light from LEDs. For example, FIG. 6E shows an installation of the above LED button 100 packages that are arranged to display alphabet A.

[0057] While specific embodiments have been described and illustrated, it is understood that many changes, modifications, variations and combinations thereof could be made to the present invention without departing from the scope of the present invention. For example, the arch-shaped or dome-shaped spring may comprise a hole so that the spring may be disposed on the upper contact element 125 of the LED button package 100 and light from the emitting element can radiate through the hole. Such arch-shaped or dome-

shaped spring may also be disposed on the contact element(s) of the LED ring package 200 or LED surface mount package 400. Similarly, the coiled spring may be disposed on the upper contact element 125 of the LED button package 100 or contact element(s) of the LED ring package 200 or LED surface mount package 400 such that the coils of the spring do not interfere with light radiating through the coiled spring. Accordingly, the scope of the present invention is defined in the appended claims and as supported by the above description and figures.

CLAIMS:

1. A light emitting diode (LED) package comprising:
a light emitting element and its anode and cathode terminals;
a housing moulding at least part of said light emitting element, anode and cathode terminals; and
two contact elements supported by said housing for power lead-in to said light emitting element, wherein said two contact elements define two substantially planar but spaced apart contact planes.
2. A LED package according to claim 1, wherein said housing is disk-shaped and each said contact element is formed on each of two faces of said disk-shaped housing.
3. A LED package according to claim 1 or 2, wherein said contact elements are spaced apart on opposite faces of said housing and they are separately connected to said anode and cathode terminals.
4. A LED package according to claim 2 or 3, wherein the disk-shaped housing has a profile that is round, oval, polygonal, star, floral, alphabet, numeral or any combination thereof.
5. A LED package according to any one of claims 2-4, wherein said light emitting element comprises a plurality of light emitting elements and said plurality of light emitting elements are mounted along a peripheral surface of said disk-shaped housing.
6. A LED package according to claim 5, wherein said plurality of light emitting elements are arranged in one or more rows.
7. A LED package according to any one of claims 1-4, wherein said contact elements are planar and one of said contact element comprises an aperture so that light operable to emit from said light emitting element radiates out through said aperture.
8. A LED package according to any one of claims 1-4, wherein said contact elements are planar, said light emitting elements comprises two light emitting elements and each of

said contact elements comprises an aperture so that light emitting from said two light emitting elements radiates out through said associated aperture.

9. A LED package according to any one of claims 1-6, wherein said package comprises a hole formed through its thickness.

10. A LED package according to claim 9, wherein said hole is provided by an insert.

11. A LED package according to claim 10, wherein said hole is threaded through or in two sections.

12. A LED package according to any one of the preceding claims, wherein said contact elements are planar and at least one of said contact element comprises a spring.

13. A LED package according to claim 12, wherein said spring is a leaf, arch-shaped, dome-shaped or coiled spring.

14. A LED package according to claim 1, wherein said contact elements comprise four or more wings, two or more of said wings extend upward to define one of said contact planes above a top of said housing whilst two or more of said wings extend downward to define another of said contact planes below said housing.

15. A LED package according to claim 1, wherein said contact elements are planar and one of said two contact elements surrounds said light emitting element such that said housing extends out of said associated contact element.

16. A LED package according to claim 15, further comprises a conductive adaptor so that one of said two substantially planar but spaced apart contact planes is above said housing.

17. A LED-illuminated panels assembly comprising:

two spaced apart panels arranged in a face-to-face relation, wherein each of two inside surfaces of said panel assembly has a transparent but electrically conductive layer; and

a LED package according to any one of claims 1-16 being sandwiched between said two spaced apart panels, so that a DC power supply, connectable to said electrically conductive layers, delivers electric power to light up said light emitting element.

18. A LED-illuminated panels assembly according to claim 17, wherein said contact elements of said LED package are attached to associated said transparent but electrically conductive layer by conductive adhesive.

19. A LED-illuminated panels assembly comprising:

two spaced apart panels arranged in a face-to-face relation, wherein each of two inside surfaces of said panel assembly has a transparent but electrically conductive layer;

a LED package according to any one of claims 1-11 or 16 being sandwiched between said two spaced apart panels; and

an electrically conductive ring disposed between at least one of said contact element and associated said electrically conductive layer, so that a DC power supply, connectable to said electrically conductive layers, delivers electric power to light up said light emitting element.

20. A LED-illuminated panels assembly comprising:

two spaced apart panels arranged in a face-to-face relation, wherein each of two inside surfaces of said panel assembly has a transparent but electrically conductive layer;

a LED package according to any one of claims 9-11 being sandwiched between said two spaced apart panels; and

a bolt, disposed in holes formed through said two spaced apart panels that are also in register with said hole through said LED package, cooperating with a nut is operable to clamp said panel assembly together.

21. A LED-illuminated panels assembly comprising:

two spaced apart panels arranged in a face-to-face relation, wherein each of two inside surfaces of said panel assembly has a transparent but electrically conductive layer;

a LED package according to claim 11 being sandwiched between said two spaced apart panels; and

a screw associated with each of said two spaced apart panels is operable to engage with said threaded insert to clamp said panel assembly together.

22. A LED-illuminated panels assembly according to any one of claims 17-21, wherein said transparent but electrically conductive layer comprises a transparent conductive oxide layer.

23. A LED-illuminated panels assembly according to claim 22, wherein said panels comprise transparent glass or plastic.