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(54) Interconnectable LED modules and method of interconnecting LED modules

(57) An interconnectable LED module (10) comprises a generally planar substrate (13) with a main surface, the substrate (13) having a regular convex polygon shape, at least one LED (3) disposed on the main surface of the substrate (13), the at least one LED (3) connected in a series arrangement between a first terminal node (14) and a second terminal node (15) on the main surface of the substrate (13), a plurality of first terminal pads (1), each arranged on a respective polygon edge (11, 12) of the main surface of the substrate (13), the plurality of first terminal pads (1) being electrically connected to the first terminal node (14), and a plurality of second terminal pads (2), each arranged on a respective polygon edge (11, 12) of the main surface of the substrate (13), the plurality of second terminal pads (2) being electrically connected to the second terminal node (15), wherein the respective first terminal pads (1) and second terminal pads (2) on each polygon edge (11, 12) of the main surface of the substrate (13) are arranged adjoining to each other along the respective edge such that the order of the first and second terminal pads (1, 2) of opposing polygon edges (11, 12) of the main surface of the substrate (13) when going in a clockwise direction around the edges of the substrate (13) is reversed with respect to each other. The LED modules (10) may be connected to provide an LED array having a plurality of interconnected LED modules (10).

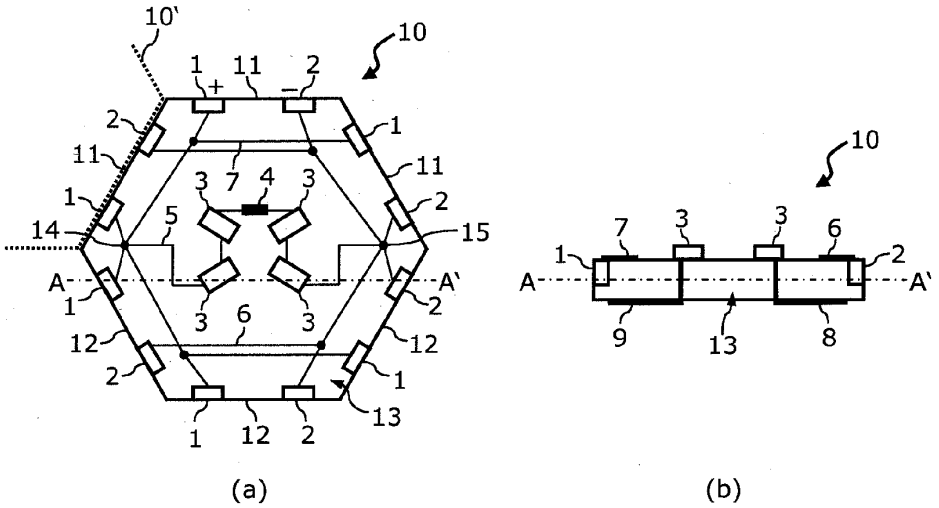

Fig. 1

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Description

Technical Field of the Invention

[0001] The present invention pertains to interconnectable LED modules and a method of interconnecting LED modules, as well as an LED array of a plurality of interconnected LED modules.

Background of the Invention

[0002] Lighting devices comprising light emitting diodes (LEDs) enjoy increasing popularity. Due to their low energy consumption, in color and brightness and versatility in the range of applications, there is an increasing demand for LED lighting devices. In particular for background lighting applications such as LED television sets, traffic signs, or illuminated wall panels for advertising purposes or atmospheric illumination, LED devices are widely used. In order to increase the flexibility of the application of LED devices, modular LED building blocks have been envisaged which may be interconnected to bigger array structures.

[0003] Document US 2008/0170396 A1 discloses a light emitting device comprising a substrate cut out in a hexagonal shape, a plurality of LEDs mounted on the substrate and connection terminals of one polarity at the side edges of the substrate.

[0004] Document US 2009/0244871 A1 discloses building blocks for an LED array having matching terminal blocks and sockets disposed on the side edge of the building blocks which may be interconnected by a coupling buckle.

[0005] Document US 2011/0309401 A1 discloses a light emitting diode module with a hexagonal substrate, LEDs mounted on the substrate and terminal sets corresponding to socket sets disposed on the surface of the substrate.

[0006] There is a need for modular building blocks with light emitting diodes that can be interconnected in an easy, flexible and foolproof manner. The array assembled from such building blocks should have good scalability in array size, three-dimensional extension and illuminating power, low maintenance requirements and independence from the type, power rating and light color of the light emitting diodes.

Summary of the Invention

[0007] Accordingly, an idea of the present invention is to provide a substrate shaped in regular polygonal format having one or more light emitting diodes mounted thereon. The light emitting diodes are electrically connected in series. Each of the terminal nodes of this series connection is electrically connected to a plurality of terminal branches of a respective polarity which are coupled to first and second terminal pads disposed on respectively different edges of the polygonal substrate. Each of the different edges of the polygonal substrate comprises two terminal pads of opposing polarity. The two terminal pads on each edge of the polygonal substrate are arranged in a neighboring fashion to each other along the rim of the substrate. The sequential order of the two terminal pads may be specifically predetermined such that the order of the terminal pads of opposing substrate edges when going in a clockwise direction around the edges of the substrate is reversed with respect to each other.

[0008] One advantage of such a light emitting diode module is the modularity. Due to the way the terminal pads are arranged at the edges of the substrate it is possible to connect two or more substrate modules as tiles of tiled array of light emitting diode modules. Such a connection allows for the construction of a network of substrate modules.

[0009] A particular advantage is the scalability of the network or array: The size or extension of the array may be increased or decreased at any time by adding or removing one or more of the substrate modules. The scalability is only limited by the current available from the power source and its capability of providing enough power for the number of light emitting diodes in the array of substrate modules.

[0010] Because of the modular nature of the array and the recursivity of the arrangement of terminal pads along the ridges of the array the power source may be connected at any border edge of any substrate module. Moreover, the array of substrate modules may be built in any desired larger shape since there is no risk of creating unintended short circuits or current loops among the substrate modules.

[0011] Furthermore, the maintenance and repair costs and efforts are kept particularly low since the LED modules may be exchanged on a one-by-one basis without affecting the topology of the remaining LED array. Moreover, the failure or defect of a single LED module does not affect the functionality and overall performance of the remaining LED array in a substantial or critical manner. The LED array may continue working until the broken or defect LED module is replaced.

[0012] Consequently, a first aspect of the present invention relates to an interconnectable LED module, comprising a generally planar substrate with a main surface, the substrate having a regular convex polygon shape, at least one LED disposed on the main surface of the substrate, the at least one LED connected in a series arrangement between a first terminal node and a second terminal node on the main surface of the substrate, a plurality of first terminal pads, each arranged on a respective polygon edge of the main surface of the substrate, the plurality of first terminal pads being electrically connected to the first terminal node, and a plurality of second terminal pads, each arranged on a respective polygon edge of the main surface of the substrate, the plurality of second terminal pads being electrically connected to the second terminal node, wherein the respective first terminal pads and second terminal pads on each

polygon edge of the main surface of the substrate are arranged adjoining to each other along the respective edge such that the order of the first and second terminal pads of opposing polygon edges of the main surface of the substrate when going in a clockwise direction around the edges of the substrate is reversed with respect to each other.

[0013] According to an embodiment of the first aspect the substrate may have a regular convex hexagonal shape or a regular convex octagonal shape. Particularly hexagonal shapes are advantageous for a seamless tiling arrangement of LED modules. Moreover, hexagonal shapes are easy to manufacture and require only little wiring for the LEDs.

[0014] According to a further embodiment of the first aspect, the respective first terminal pads and second terminal pads on each polygon edge on one half of the substrate may have the same the order of the first and second terminal pads when going in a clockwise direction around the edges of the substrate. Such an arrangement is particularly useful in avoiding any shortcuts irrespective of the number of interconnected LED modules in an LED array.

[0015] According to a further embodiment of the first aspect, the first terminal pads and second terminal pads are at least partially arranged on a side face of the substrate. This has the advantage that neighboring terminal pads of LED modules to be interconnected may be easily electrically connected, for example by means of soldering.

[0016] According to a further embodiment of the first aspect, the LED module may further comprise a resistor being arranged on the main surface of the substrate and being connected in series to the at least one LED. According to a further embodiment of the first aspect, the resistor may comprise a resistor element having an adjustable resistance value. With such a resistor the resistance value of the resistor may be adapted to the number and type of LEDs disposed on an LED module. In particular, differently colored LEDs may have different rated currents and by adjusting the resistance value of the resistor the overall current through an LED module may be matched to the number and type of LEDs used.

[0017] According to a further embodiment of the first aspect, the substrate may comprise a printed circuit board, PCB.

[0018] According to a further embodiment of the first aspect, the plurality of first terminal pads may be electrically connected to the first terminal node by first conductive traces and the plurality of second terminal pads may be electrically connected to the second terminal node by second conductive traces. According to a preferred embodiment, at least parts of the first and second conductive traces may be arranged on a surface opposite to the main surface of the substrate. This allows for a space saving arrangement of all conductive elements on the substrate, thus providing small modular LED building blocks. Moreover, the percentage of space taken up by the LEDs on the main surface of the substrate may be higher, thus allowing for higher luminance of the LED array of interconnectable LED modules.

[0019] A second aspect of the present invention relates to a method of interconnecting LED modules, comprising the steps of disposing at least one LED on a main surface of a generally planar substrate, the substrate having a regular convex polygon shape, connecting the at least one LED in a series arrangement between a first terminal node and a second terminal node on the main surface of the substrate, forming a plurality of first terminal pads, each arranged on a respective polygon edge of the main surface of the substrate, electrically connecting the plurality of first terminal pads to the first terminal node, forming a plurality of second terminal pads, each arranged on a respective polygon edge of the main surface of the substrate, and electrically connecting the plurality of second terminal pads to the second terminal node, wherein the respective first terminal pads and second terminal pads on each polygon edge of the main surface of the substrate are arranged adjoining to each other along the respective edge such that the order of the first and second terminal pads of opposing polygon edges of the main surface of the substrate when going in a clockwise direction around the edges of the substrate is reversed with respect to each other.

[0020] A third aspect of the present invention relates to an LED array of interconnected LED modules, the LED array comprising a plurality of interconnected LED modules according to the first aspect, wherein a first LED module is aligned with a bordering edge of the substrate along a bordering edge of the substrate of a second LED module, and wherein the respective first terminal pads and the respective second terminal pads at the bordering edges of the first and second LED modules are electrically connected.

[0021] According to an embodiment of the third aspect the respective first terminal pads and the respective second terminal pads may be interconnected by means of a soldering spot. This advantageously allows for a seamless connection of LED modules and avoids the use of additional connection elements such as connector plugs or bridges.

[0022] According to a further embodiment of the second aspect the planes of extension of the substrates of bordering LED modules may be inclined by an angle with respect to each other. Due to the

[0023] According to a further embodiment of the second aspect the angle may have a value between 30° and 50°, in particular between 35° and 45°, in particular between 38° and 42°, in particular 37,4° or 41,8°.

Brief Description of the Drawings

[0024] The accompanying drawings are included to provide a further understanding of the disclosure. They illustrate embodiments and may help to explain the principles of the invention in conjunction with the description.

Other embodiments and many of the intended advantages, envisaged principles and functionalities will be appreciated as they become better understood by reference to the detailed description as following hereinbelow. The elements of the drawings are not necessarily drawn to scale relative to each other. In general, like reference numerals designate corresponding similar parts.

Fig. 1 schematically illustrates an LED module according to an embodiment of the present invention.

Fig. 2 schematically illustrates a further LED module according to another embodiment of the present invention.

Fig. 3 schematically illustrates a wiring scheme of an LED module according to a further embodiment of the present invention.

Fig. 4 schematically illustrates an LED array of interconnected LED modules according to a further embodiment of the present invention.

Fig. 5 schematically illustrates a further LED array of interconnected LED modules according to another embodiment of the present invention.

Fig. 6 schematically illustrates an embodiment of a method of interconnecting LED modules.

Detailed Description

[0025] In the following detailed description, reference is made to the accompanying drawings, and in which, by way of illustration, specific embodiments are shown. It should be obvious that other embodiments may be utilized and structural or logical changes may be made without departing from the scope of the present invention. Unless specifically noted otherwise, functions, principles and details of each embodiment may be combined with other embodiments. Generally, this application is intended to cover any adaptations or variations of the specific embodiments discussed herein. Hence, the following detailed description is not to be taken in a limiting sense, and the scope of the present invention is defined by the appended claims.

[0026] In the following, reference is also made to methods and method steps, which are schematically and exemplarily illustrated in flow charts and block diagrams. It should be understood that the methods described in conjunction with those illustrative drawings may easily be performed by embodiments of systems, apparatuses and/or devices as well. In particular, it should be obvious that the systems, apparatuses and/or devices capable of performing the detailed block diagrams and/or flow charts are not necessarily limited to the systems, apparatuses and/or devices shown and detailed herein below, but may rather be different systems, apparatuses and/or devices. The terms "first", "second", "third", etc. are used merely as labels, and are not intended to impose numerical requirements on their objects or to establish a certain ranking of importance of their objects.

[0027] Fig. 1 shows a schematical illustration of an LED module 10, both in top view (a) and sectional view (b) along the section line A-A' as indicated in Fig. 1 (a). The LED module 10 comprises a generally planar substrate 13 with a main surface, the substrate 13 having a regular convex polygon shape, for example a regular convex hexagonal shape or a regular convex octagonal shape. Any other shape of the substrate 13 may be possible as well, in particular shapes with an even amount of edges. An exemplary octagonal shape for the substrate 13 is shown by way of example in Fig. 2.

[0028] The substrate 13 may for example comprise a printed circuit board (PCB) which is cut out in the desired polygonal shape.

[0029] The LED module 10 may comprise at least one LED 3 disposed on the main surface of the substrate 13, wherein the at least one LED 3 is electrically connected in a series arrangement 5 between a first terminal node 14 and a second terminal node 15 on the main surface of the substrate 13. The number and type of LEDs 3 may be chosen according to the desired lighting characteristics. In Fig. 1, four LEDs 3 are shown as an example, however, any other number of LEDs 3 may be possible as well. The arrangement of the LEDs 3 on the substrate 13 or their respective arrangement with respect to each other may be chosen depending on the type or number of the LEDs or with respect to the desired lighting characteristics of the LED module 10. For example, the LEDs 3 may be arranged symmetrically around the center of the polygonal shape of the substrate 13 in order to achieve a uniform and evenly distributed light emission.

[0030] The LED module 10 comprises a plurality of first terminal pads 1, each arranged on a respective polygon edge 11 or 12 of the main surface of the substrate 13, the plurality of first terminal pads 1 being electrically connected to the first terminal node 14. Similarly, the LED module 10 comprises a plurality of second terminal pads 2, each arranged on a respective polygon edge 11 or 12 of the main surface of the substrate 13, the plurality of second terminal pads 2 being electrically connected to the second terminal node 15. The electrical connection between the first and second terminal pads 1 and 2 and the respective terminal nodes 14 and 15 may in each case be implemented by electrically conductive traces or wirings 6 and 7, respectively, which are arranged on the main surface of the substrate 13. Alternatively or additionally, it may also be possible to provide for conductive traces or wirings 8 and 9 on the surface opposite to the main surface of the substrate 13, as exemplarily shown in Fig. 1 (b). The conductive traces 8 and 9 may for example be guided along the lower surface of the substrate 13 and be connected to the elements on the main surface of the substrate 13 by means of vias or through-holes in

the substrate 13. By providing conductive traces 8 and 9 on the backside or lower surface of the substrate 13 the LED module 10 may be implemented in a more compact way, leaving a greater percentage of the main surface of the substrate 13 being covered by the LEDs 3, thus leading to a higher illumination capacity per unit of area.

[0031] The respective first terminal pads 1 and second terminal pads 2 on each polygon edge 11 and 12 of the main surface of the substrate 13 are arranged adjoining to each other along the respective edge such that the order of the first and second terminal pads 1 and 2 of opposing polygon edges 11 and 12 of the main surface of the substrate 13 when going in a clockwise direction around the edges of the substrate 13 is reversed with respect to each other. In other words, the respective polygon edges of the substrates 13 of congruent and neighboring LED modules 10 that are brought into contact comprise respective first and second terminal pads 1 and 2 which lie opposite of their respective counterpart first and second terminal pads 1 and 2 of the same polarity.

[0032] The first terminal pads 1 and second terminal pads 2 may be configured as terminal pads of opposing polarity - for example, the first terminal pads 1 may be configured to be connected to a positive potential of a power supply and thus carry a positive polarity, whereas the second terminal pads 2 may be configured to be connected to a negative potential of the power supply and thus carry a negative polarity. Therefore, a power supply connected by way of the first terminal pads 1 and second terminal pads 2 may supply a voltage over the series connection of LEDs 3, so that a current may traverse the series connection of LEDs 3, thus lighting the LEDs 3.

[0033] The first and second terminal pads 1 and 2 may for example be metallization pads covering a coupling area on the main surface of the substrate 13. It may also be possible to form the first and second terminal pads 1 and 2 at least partly on the rim of the substrate 13, the rim being perpendicular to the main surface of the substrate 13, i.e. the first and second terminal pads 1 and 2 may at least partially be arranged on a side face of the substrate 13. That way, the terminal pads 1 and 2 of bordering LED modules 10 may be brought into electrical contact when interconnecting the LED modules 10 by touching the respective rims of the polygon edges of the substrates 13.

[0034] As shown in Fig. 1 (a), the respective first and second terminal pads 1 and 2 on each polygon edge on one half of the substrate 13 have the same the order of the first and second terminal pads 1 and 2 when going in a clockwise direction around the edges of the substrate 13. For example, all the polygon edges denoted with the reference numeral 11 have the first terminal pads 1 preceding the second terminal pads 2 in sequence when going in a clockwise direction around the edges of the substrate 13. On the contrary, the polygon edges denoted with the reference numeral 12 have the second terminal pads 2 preceding the first terminal pads 1 in sequence when going in a clockwise direction around the edges of the substrate 13. The polygon edges 11 lie on one half of the substrate 13, whereas the polygon edges 12 lie on the other half of the substrate 13. With such an arrangement of terminal pads 1 and 2 a foolproof mechanism may be guaranteed when connecting two LED modules 10.

[0035] As indicated in Fig. 1(a) with the dotted line, a second LED module 10' having the same features and being congruent to the LED module 10 may be arranged in an adjoining fashion to the LED module 10 so that the respective terminal pads 1 or 2 of the same polarity face each other. Irrespective of where such a second LED module 10' is arranged at the border of the LED module 10, in each case the terminal pads 1 or 2 of the same polarity come to lie next to each other. That way, it is impossible to unintentionally create short circuits which, in operation of the LED modules 10 and 10', may threaten the functionality or operation safety of the LED modules 10 and 10'

[0036] The LED module 10 may also comprise a resistor 4 being arranged on the main surface of the substrate 13 and being electrically connected in series to the at least one LED 3. A schematic circuit diagram of an exemplary way of electrically connecting the elements on the main surface of the substrate 13 of the LED module 10 is shown in Fig. 3. The resistor 4 and the LEDs 3 are connected by a series connection 5 between the terminal nodes 14 and 15. At the terminal nodes 14 and 15, the conductive traces branch up into a number of terminal pads 1 and 2, respectively, the overall number of which depends on the polygonal shape of the substrate 13, i. e. the number of polygon edges.

[0037] The resistor 4 may for example comprise a resistor element having an adjustable resistance value. In this case, the resistance value may be adapted to the rated current of the LEDs 3 which may depend on their type and number. For example, colored LEDs 3 may be used instead of white LEDs 3 for which the required operation current is different. The resistor 4 with an adjustable resistance value may be used to match the overall current requirements of the LED module 10 to the current requirements of other LED modules 10 having a different number and/or type of LEDs 3.

[0038] Fig. 4 shows an exemplary arrangement of interconnected LED modules to an LED array 20. The LED array 20 comprises a plurality of interconnected LED modules, for example LED modules 10 as explained in conjunction with Figs. 1 to 3. A first LED module 10 is aligned with a bordering edge of the substrate 13 along a bordering edge of the substrate 13 of a second LED module 10, so that the respective first terminal pads 1 and the respective second terminal pads 2 at the bordering edges of the first and second LED modules 10 are electrically connected.

[0039] The respective first terminal pads 1 and the respective second terminal pads 2 may, for example, in each case be interconnected by means of a soldering

spot 21, as shown in Fig. 5. Moreover, as shown in Fig. 5, the use of a soldering spot 21 may be preferable, when the terminal pads 1 and 2 are arranged at least partially on the side face of the substrate 13. Alternatively, it may also be possible to use other means of electrical connection, including - but not limited to - electrically conductive wires and bridging connectors or plugs.

[0040] The planes of extension of the substrates 13 of bordering LED modules 10 may be inclined by an angle β with respect to each other. For reasons of clarity, the angle 180°-β is shown in Fig. 5. The angle β may for example have a value between 30° and 50°, in particular between 35° and 45°, in particular between 38° and 42°, in particular 37,4° or 41,8°. By providing angled or bent LED arrays 20 it is possible to created three dimensional LED arrays 20, according to the needs and desires of the user of the LED modules 10.

[0041] Fig. 6 shows a schematical illustration of a method 30 of interconnecting LED modules. In particular, the method 30 may utilize the LED modules as shown and explained exemplarily in conjunction with Figs. 1 to 5. The method 30 may for example be used to create LED arrays 20 comprising a plurality of LED modules 10 as shown in Figs. 4 and 5.

[0042] In a first step 31, at least one LED 3 is disposed on a main surface of a generally planar substrate 13, the substrate 13 having a regular convex polygon shape, for example a regular hexagonal or octagonal shape. Any other shape of the substrate 13 may be possible as well, in particular shapes with an even amount of edges. The arrangement of the LEDs 3 on the substrate 13 or their respective arrangement with respect to each other may be chosen depending on the type or number of the LEDs or with respect to the desired lighting characteristics of the LED module 10.

[0043] In a second step 32, the at least one LED 3 is electrically connected in a series arrangement between a first terminal node 14 and a second terminal node 15 on the main surface of the substrate 13. The series arrangement may involve forming conductive traces on the substrate 13 connecting the LEDs 3 in series between the terminal nodes 14 and 15. The conductive traces may be preformed on the substrate 13, for example as preformed metallization structures on the substrate 13. It may also be possible to provide for wiring structures after disposing the LEDs 3 on the substrate 13.

[0044] In a third step 33, a plurality of first terminal pads 1 may be formed, each arranged on a respective polygon edge 11 or 12 of the main surface of the substrate 13. In a fourth step 34, the plurality of first terminal pads 1 may be electrically connected to the first terminal node 14. Similarly, in fifth and sixth steps 35 and 36, a plurality of second terminal pads 2 may be formed, each arranged on a respective polygon edge 11 and 12 of the main surface of the substrate 13, the plurality of second terminal pads 2 being electrically connected to the second terminal node 15. The first terminal pads 1 and second terminal pads 2 may be configured as terminal pads of opposing polarity - for example, the first terminal pads 1 may be configured to be connected to a positive potential of a power supply and thus carry a positive polarity, whereas the second terminal pads 2 may be configured to be connected to a negative potential of the power supply and thus carry a negative polarity. Therefore, a power supply connected by way of the first terminal pads 1 and second terminal pads 2 may supply a voltage over the series connection of LEDs 3, so that a current may traverse the series connection of LEDs 3, thus lighting the LEDs 3. The first and second terminal pads 1 and 2 may for example be metallization pads covering a coupling area on the main surface of the substrate 13. It may also be possible to form the first and second terminal pads 1 and 2 at least partly on the rim of the substrate 13, the rim being perpendicular to the main surface of the substrate 13. That way, the terminal pads 1 and 2 of bordering LED modules 10 may be brought into electrical contact when interconnecting the LED modules 10 by touching the respective rims of the polygon edges of the substrates 13.

[0045] The respective first terminal pads 1 and second terminal pads 2 on each polygon edge of the main surface of the substrate 13 are arranged adjoining to each other along the respective edge such that the order of the first and second terminal pads 1 and 2 of opposing polygon edges of the main surface of the substrate when going in a clockwise (or alternatively counter-clockwise) direction around the edges of the substrate 13 is reversed with respect to each other. In other words, the respective polygon edges of the substrates 13 of congruent and neighboring LED modules 10 that are brought into contact comprise respective first and second terminal pads 1 and 2 which lie opposite of their respective counterpart first and second terminal pads 1 and 2 of the same polarity.

Claims

1. Interconnectable light emitting diode, LED, module (10), comprising:

a generally planar substrate (13) with a main surface, the substrate (13) having a regular convex polygon shape;

at least one LED (3) disposed on the main surface of the substrate (13), the at least one LED (3) connected in a series arrangement between a first terminal node (14) and a second terminal node (15) on the main surface of the substrate (13);

a plurality of first terminal pads (1), each arranged on a respective polygon edge (11; 12) of the main surface of the substrate (13), the plurality of first terminal pads (1) being electrically connected to the first terminal node (14); and

a plurality of second terminal pads (2), each arranged on a respective polygon edge (11; 12)

of the main surface of the substrate (13), the plurality of second terminal pads (2) being electrically connected to the second terminal node (15),
wherein the respective first terminal pads (1) and second terminal pads (2) on each polygon edge (11; 12) of the main surface of the substrate (13) are arranged adjoining to each other along the respective edge such that the order of the first and
second terminal pads (1; 2) of opposing polygon edges (11, 12) of the main surface of the substrate (13) when going in a clockwise direction around the edges of the substrate (13) is reversed with respect to each other.

2. LED module (10) according to claim 1, wherein the substrate (13) has a regular convex hexagonal shape or a regular convex octagonal shape.

3. LED module (10) according to one of the claims 1 and 2, wherein the respective first terminal pads (1) and second terminal pads (2) on each polygon edge (11; 12) on one half of the substrate (13) have the same the order of the first and second terminal pads (1; 2) when going in a clockwise direction around the edges of the substrate (13).

4. LED module (10) according to one of the claims 1 to 3, wherein the first terminal pads (1) and second terminal pads (2) are at least partially arranged on a side face of the substrate (13).

5. LED module (10) according to one of the claims 1 to 4, further comprising:

a resistor (4) being arranged on the main surface of the substrate (13) and being connected in series to the at least one LED (3).

6. LED module (10) according to claim 5, wherein the resistor (4) comprises a resistor element having an adjustable resistance value.

7. LED module (10) according to one of the claims 1 to 6, wherein the substrate (13) comprises a printed circuit board, PCB.

8. LED module (10) according to one of the claims 1 to 7, wherein the plurality of first terminal pads (1) are electrically connected to the first terminal node (14) by first conductive traces (7) and the plurality of second terminal pads (2) are electrically connected to the second terminal node (15) by second conductive traces (6), and wherein at least parts (8, 9) of the first and second conductive traces (6, 7) are arranged on a surface opposite to the main surface of the substrate (13).

9. LED array (20), comprising:

a plurality of interconnected LED modules (10) according to any of the claims 1 to 8,
wherein a first LED module (10) is aligned with a bordering edge of the substrate (13) along a bordering edge of the substrate (13) of a second LED module (10), and
wherein the respective first terminal pads (1) and the respective second terminal pads (2) at the bordering edges of the first and second LED modules (10) are electrically connected.

10. LED array (20) according to claim 9, wherein the respective first terminal pads (1) and the respective second terminal pads (2) are interconnected by means of a soldering spot (21).

11. LED array (20) according to claim 10, wherein the planes of extension of the substrates (13) of bordering LED modules (10) are inclined by an angle (β) with respect to each other.

12. LED array (20) according to claim 11, wherein the angle (β) has a value between 30° and 50°, in particular between 35° and 45°, in particular between 38° and 42°, in particular 37,4° or 41,8°.

13. Method (30) for interconnecting light emitting diode, LED, modules (10), the method comprising:

disposing (31) at least one LED (3) on a main surface of a generally planar substrate, the substrate having a regular convex polygon shape;
connecting (32) the at least one LED (3) in a series arrangement between a first terminal node and a second terminal node on the main surface of the substrate;
forming (33) a plurality of first terminal pads, each arranged on a respective polygon edge of the main surface of the substrate;
electrically connecting (34) the plurality of first terminal pads to the first terminal node;
forming (35) a plurality of second terminal pads, each arranged on a respective polygon edge of the main surface of the substrate;
and electrically connecting (36) the plurality of second terminal pads to the second terminal node,
wherein the respective first terminal pads and second terminal pads on each polygon edge of the main surface of the substrate are arranged adjoining to each other along the respective edge such that the order of the first and second terminal pads of opposing polygon edges of the main surface of the substrate when going in a clockwise direction around the edges of the substrate is reversed with respect to each other.

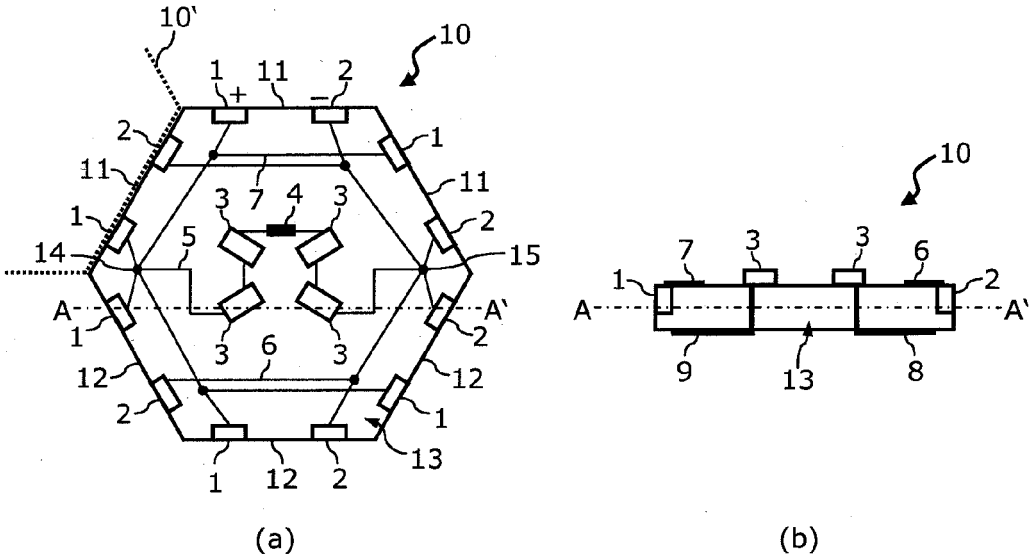

Fig. 1

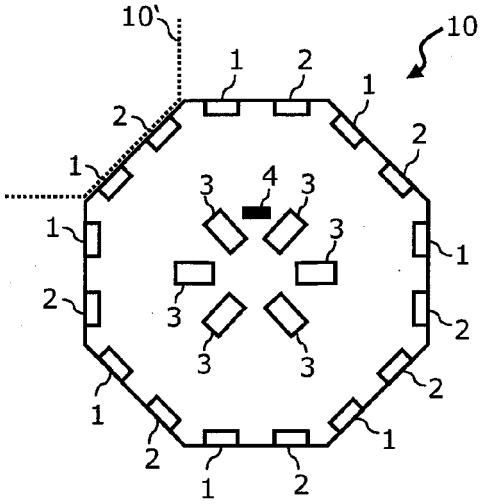

Fig. 2

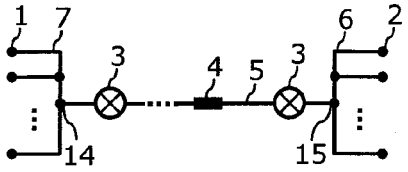

Fig. 3

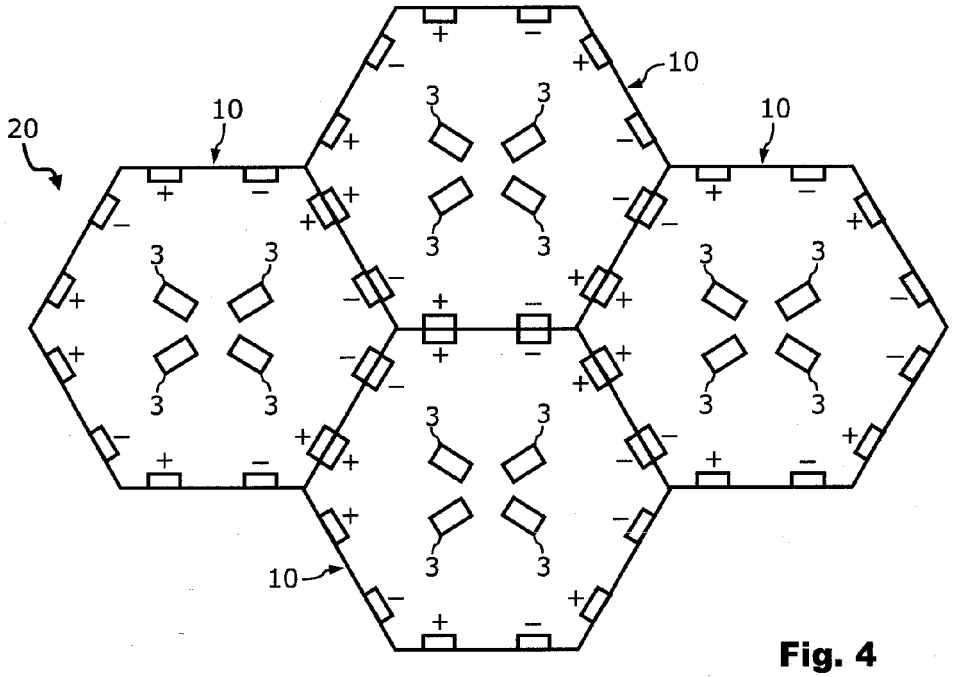

Fig. 4

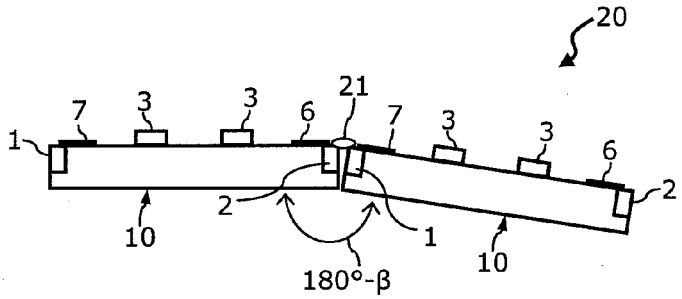

Fig. 5

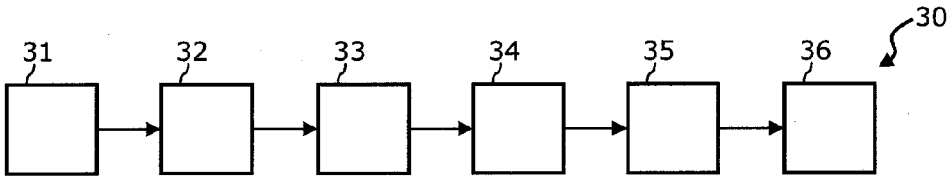

Fig. 6

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