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(54) **FLEXIBLE LEAD SURFACE-MOUNT SEMICONDUCTOR PACKAGE**

**Publication Classification**

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(57) **ABSTRACT**

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**Related U.S. Application Data**

(63) Continuation of application No. 09/756,007, filed on Jan. 8, 2001, now abandoned.

A diode chip is mounted on two bottom metal leads of a surface-mount package through two flexible links. The links are zigzag cantilevers attached to the metallic plates. The cantilevers serve as springs to support the device and to cushion any temperature stress or bending stress so as not to damage the connection between the device and the metallic leads.

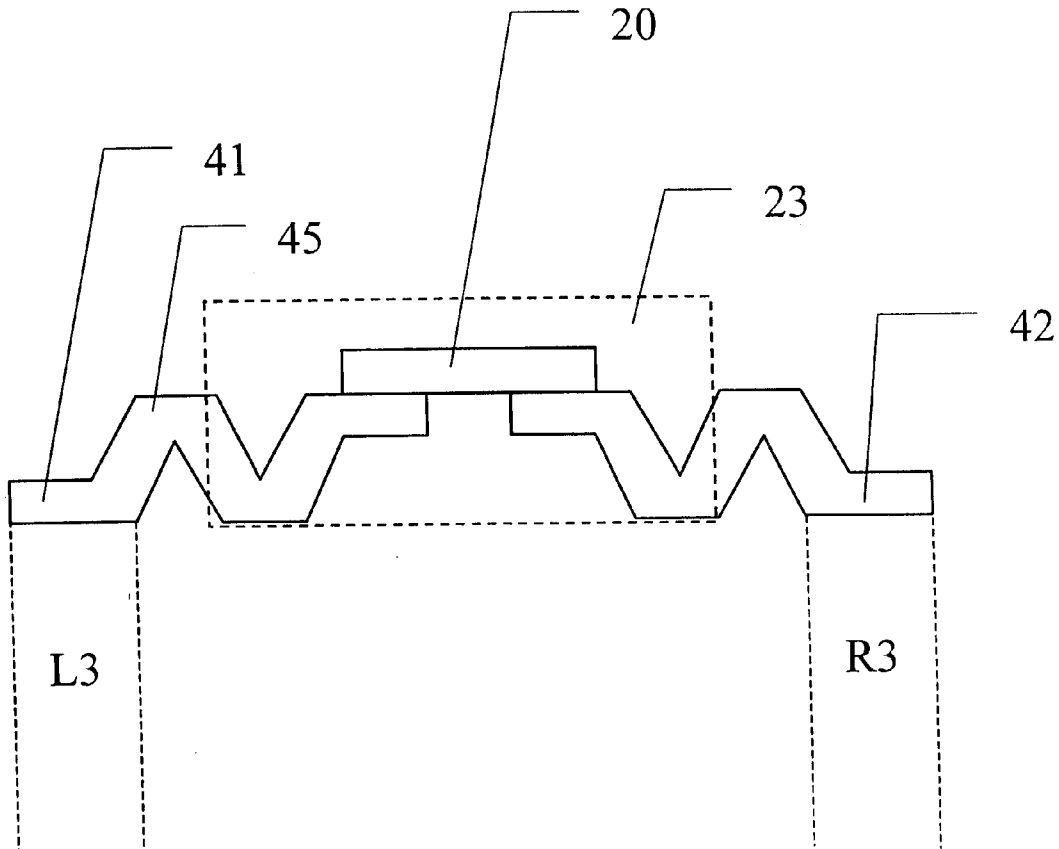


Fig.1. Prior Art

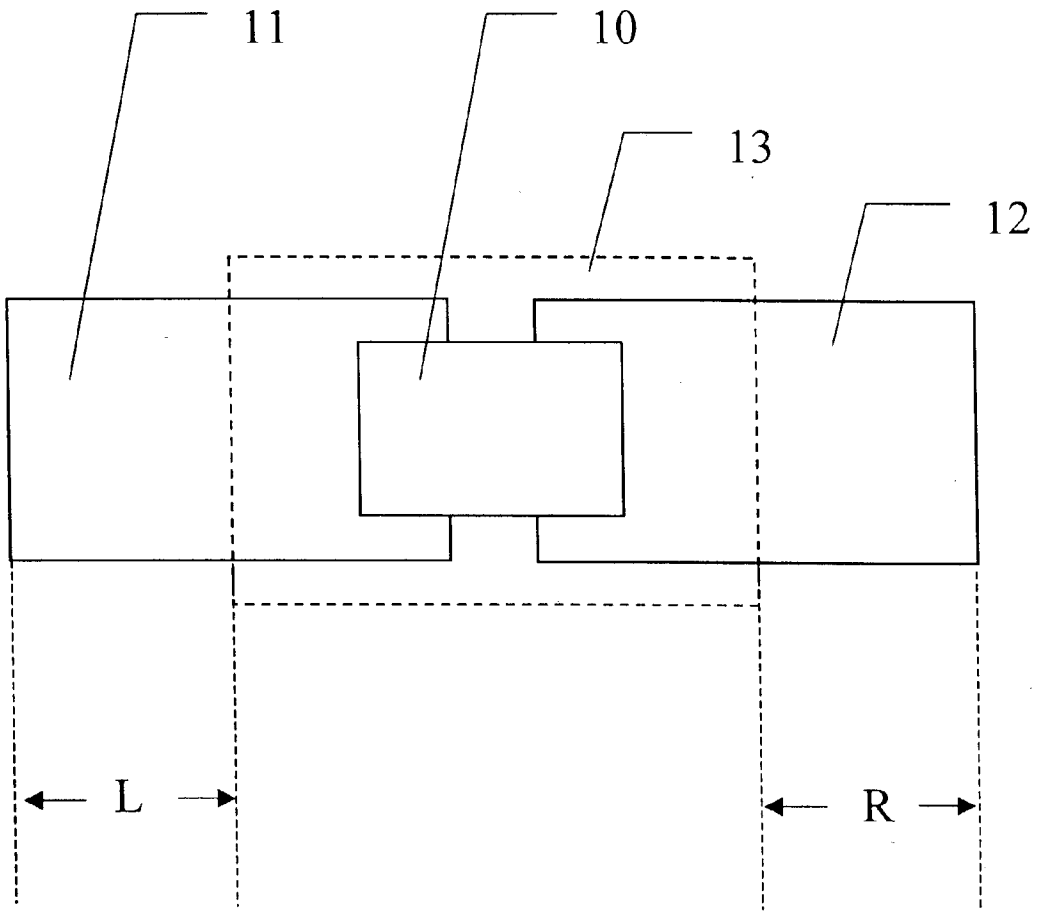


Fig.2. Prior Art

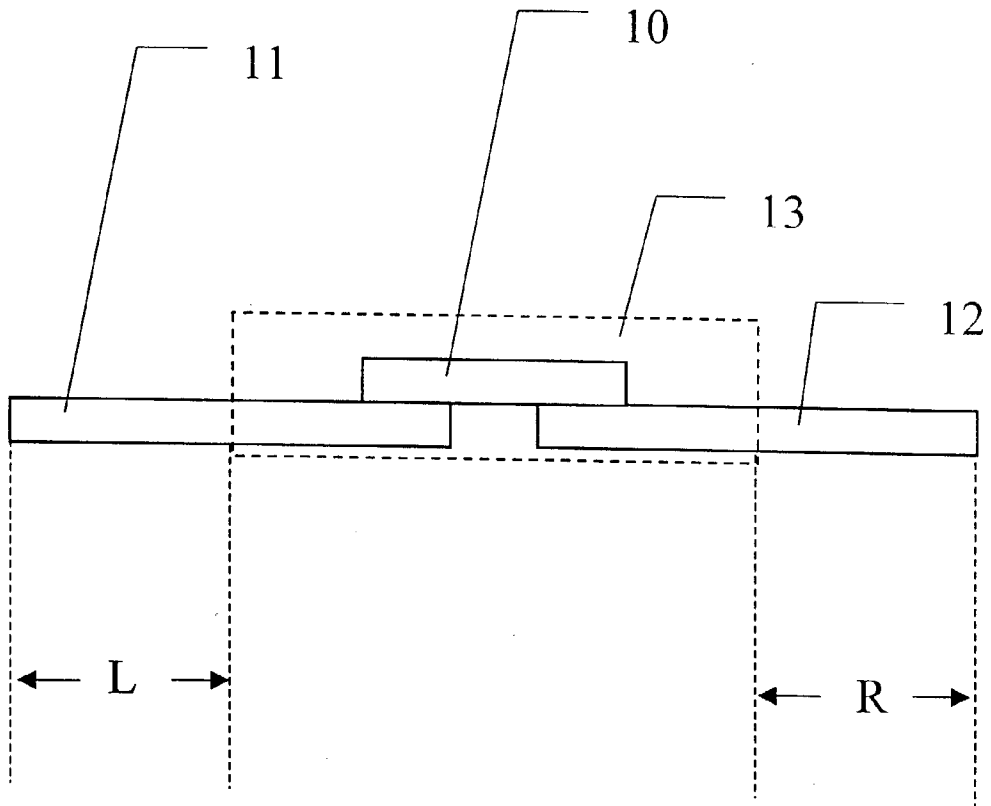


Fig.3.

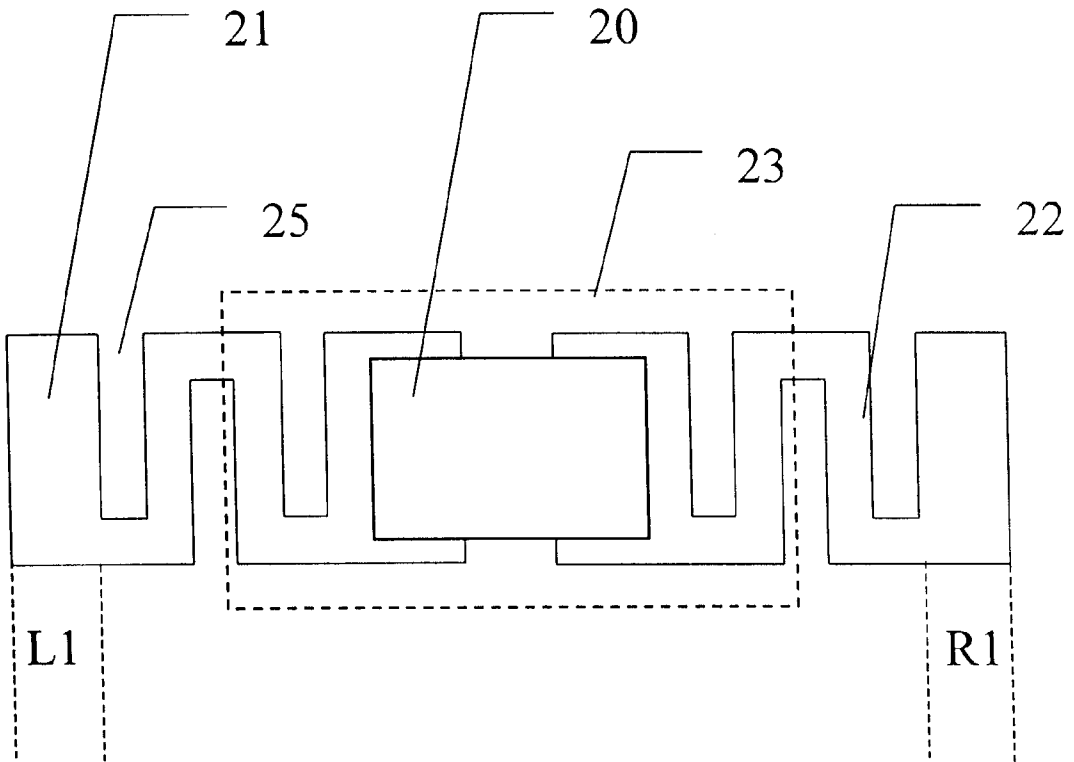


Fig.4.

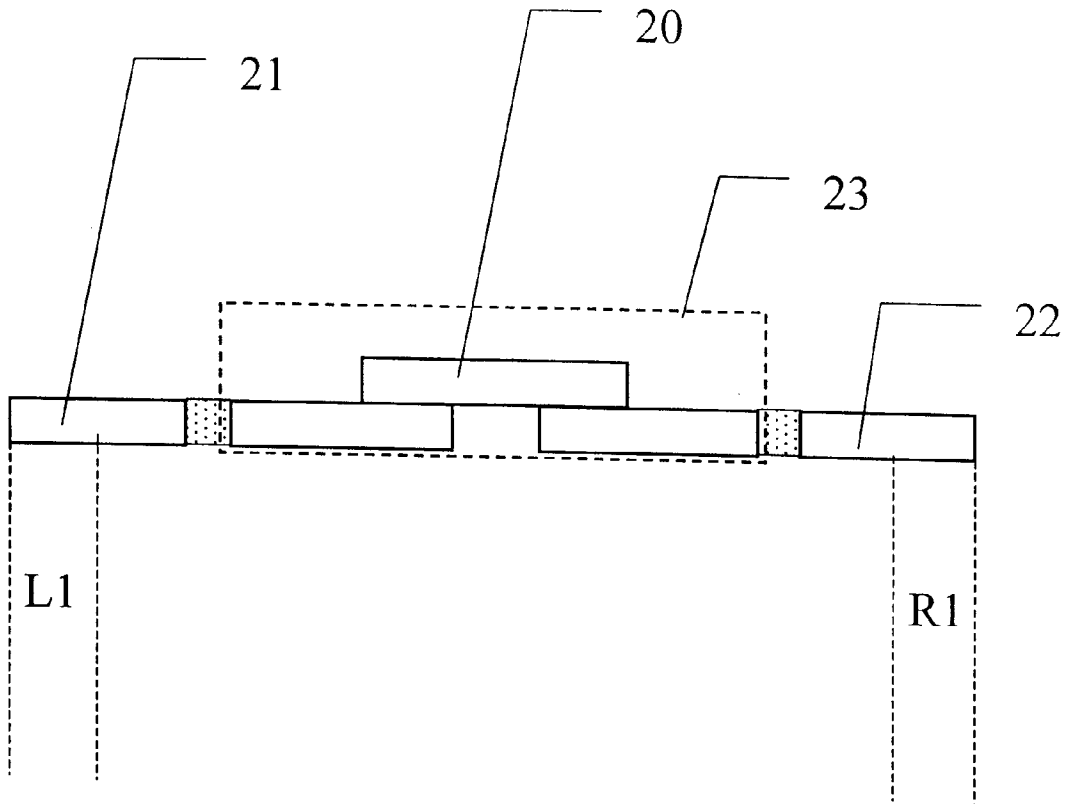


Fig.5.

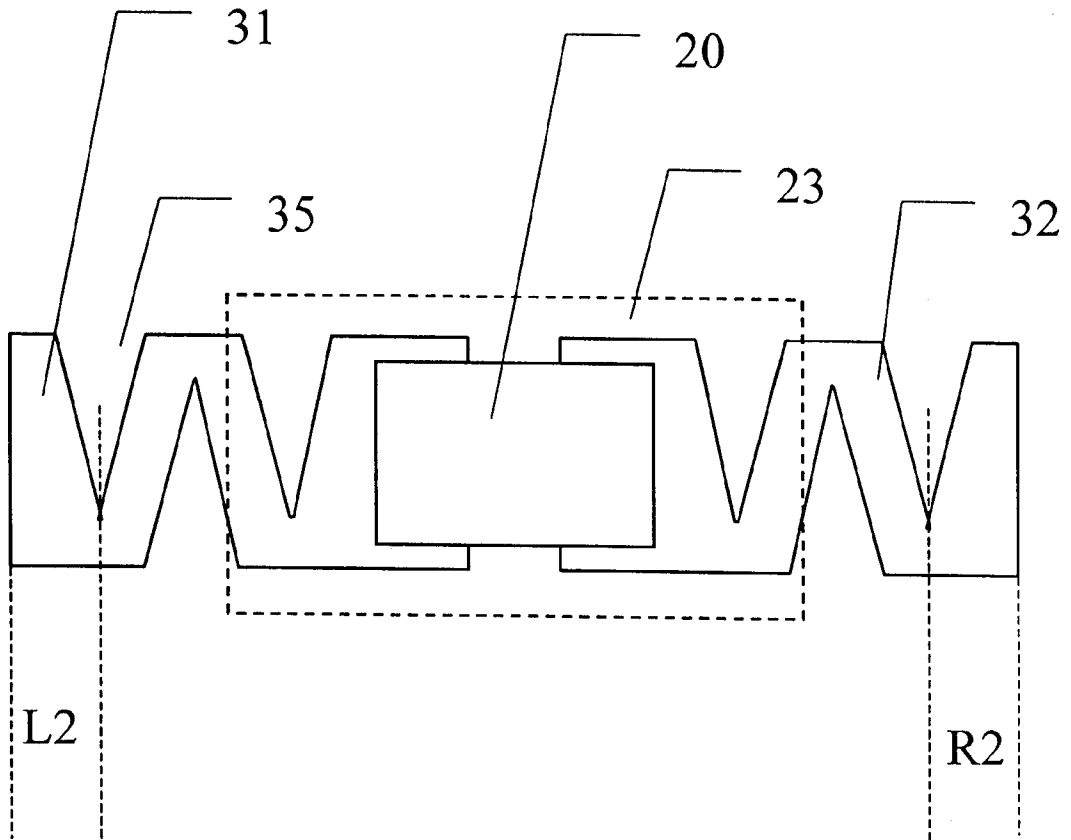


Fig.6.

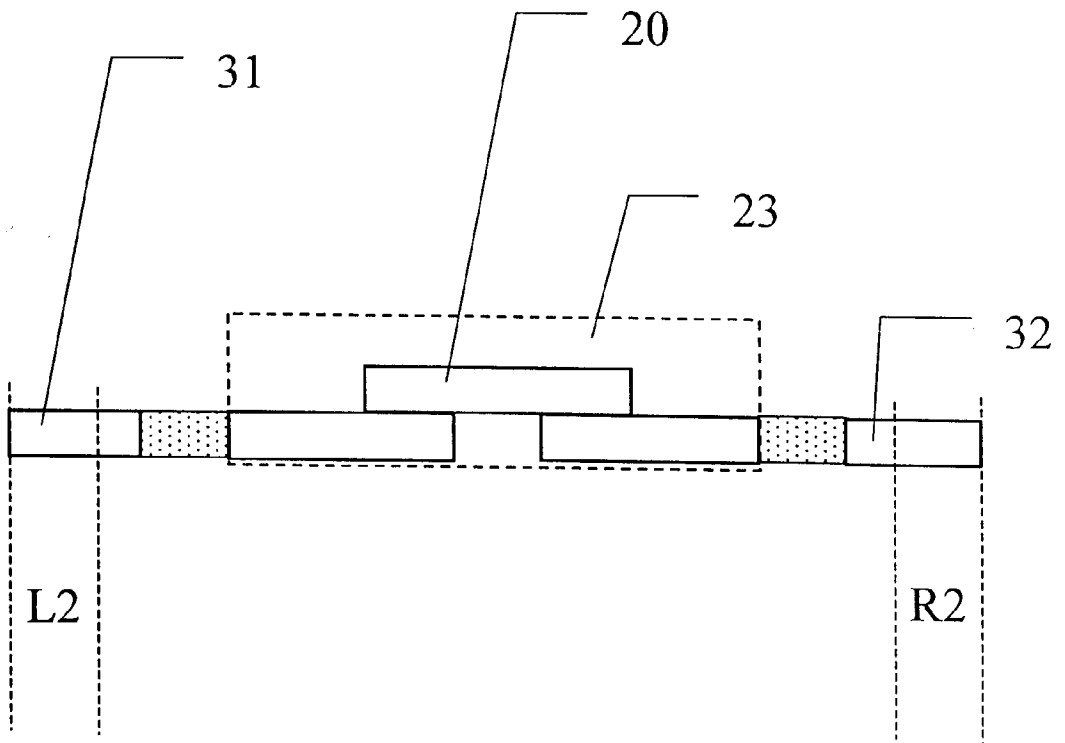


Fig.7.

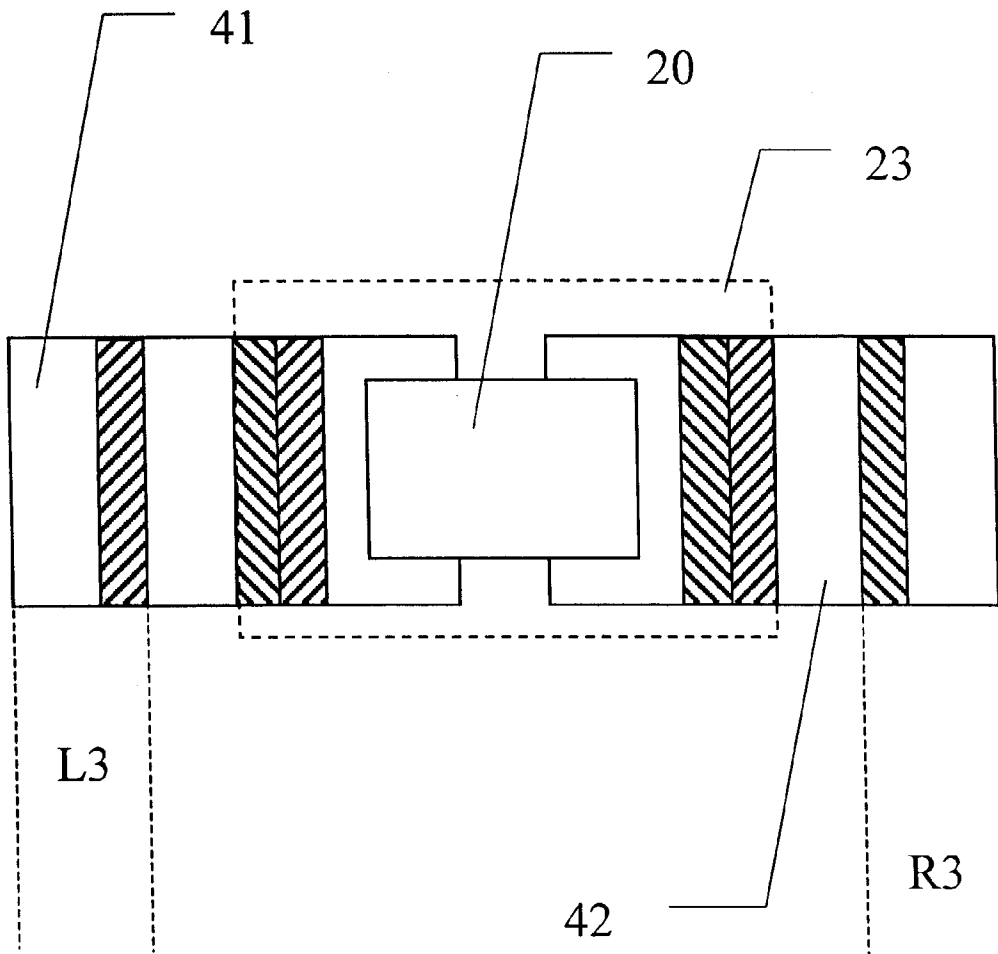




Fig.8.

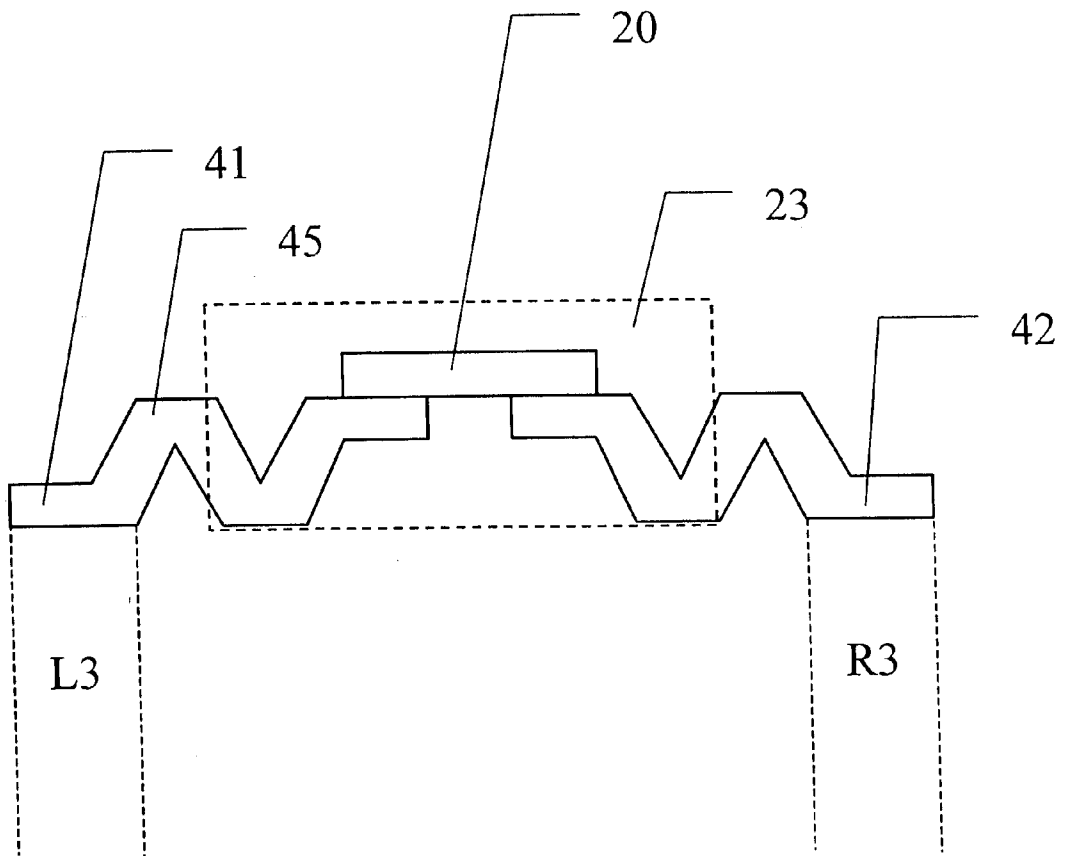


Fig.9.

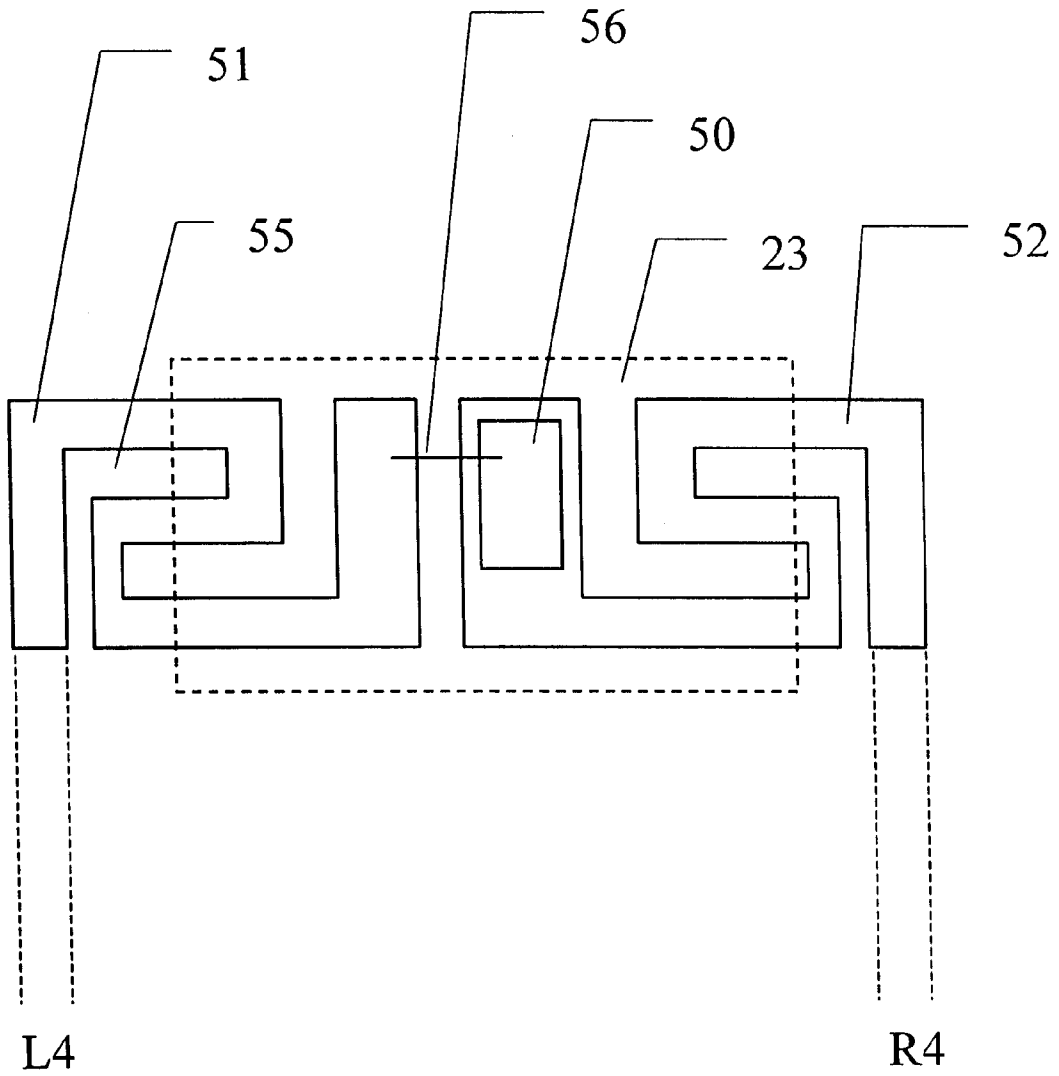
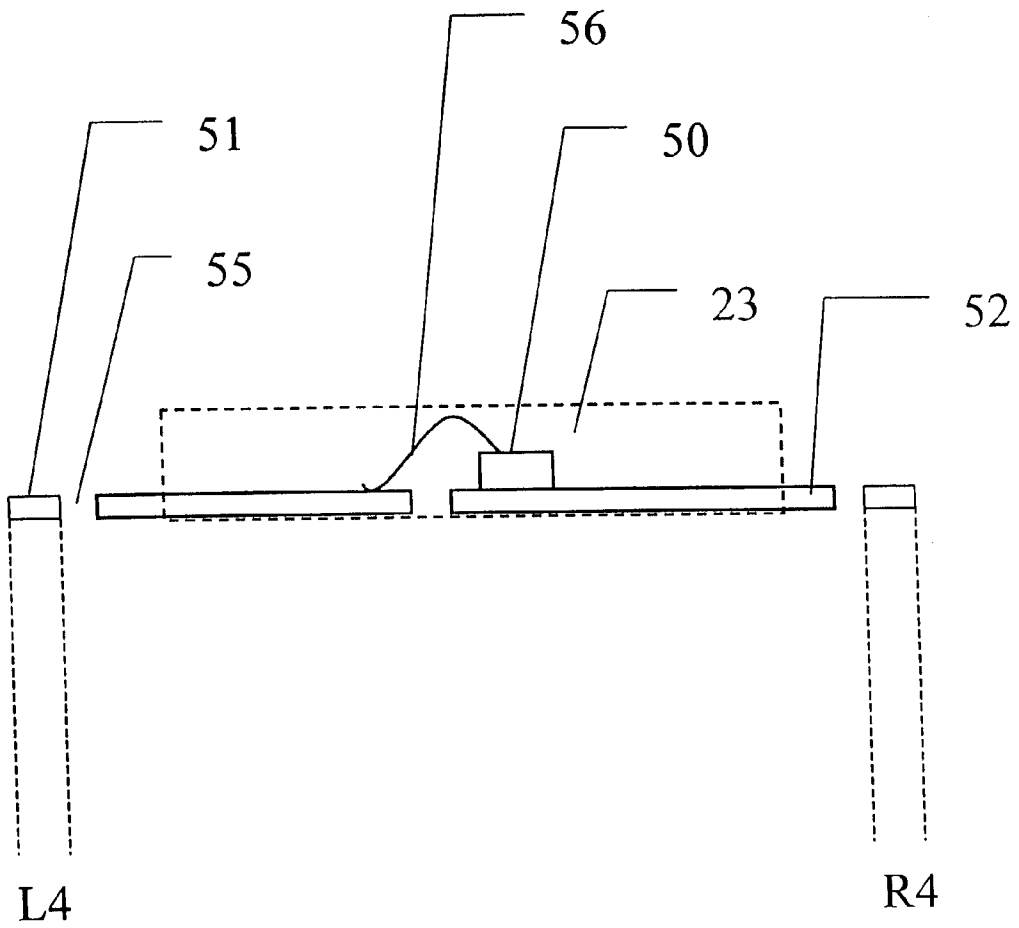


Fig.10.



## FLEXIBLE LEAD SURFACE-MOUNT SEMICONDUCTOR PACKAGE

[0001] This application is a continuation of application Ser. No. 09/756,007, filed on Jan. 8, 2001, now abandoned.

### FIELD OF INVENTION

[0002] This invention relates to semiconductor device package, particularly to surface mount optoelectric diode package, such as that for a light emitting diode (LED), a laser diode (LD), a photo diode (PD), etc. The invention is also applicable to a light sensor diode, such as a image sensor. The invention may also be applicable to packages for other non-optoelectric semiconductor devices.

### BRIEF DESCRIPTION OF THE RELATED ART

[0003] FIG. 1 shows a prior art optoelectric diode package. A semiconductor chip 10 is mounted on two metallic plates 11, 12 serving as extension leads for a surface-mount diode package. The chip 10 is sealed in glue 13 for protection. FIG. 2 shows the side view of the package. The outer portions of the metallic plates 11 and 12 are not covered with glue 13. The bottoms of the exposed portions L, R are contact surfaces for surface mounting to a motherboard. When the temperature changes, the motherboard may bend, causing the device chip 10 to break away from the metallic plates 11, 12. Then, the diode cannot function.

[0004] Another occasion for the device chip 10 to break away the metallic plates 11, 12 occurs when the diode package is mounted on a curvilinear motherboard such as a display panel. The curving of the surface can also cause bending stress on the device to damage the device. An example of such a situation occurs when a decorative light emitting ribbon is mounted at the corner of an automobile body.

[0005] Still another occasion occurs for the keys of a computer key board. Sometimes, the keys are lit with a light emitting diodes for easy recognition in the dark. Due to constant pounding the keys, the light emitting devices may dislodge from the leads.

### SUMMARY OF THE INVENTION

[0006] An object of the present invention is to prevent an optoelectric device from breaking away from the leads of a surface mount package due to temperature stress. Another object of this invention is to prevent a semiconductor device from breaking away from the leads of surface-mount package due to bending stress.

[0007] These objects are achieved by mounting a semiconductor chip to its bottom metal leads for surface mounting through two flexible links. The links are zigzag cantilevers attached to the metallic plates. The cantilevers serve as springs to support the device and to cushion any temperature stress or bending stress so as not to damage the connection between the device and the metallic leads.

### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0008] FIG. 1 shows the top view of a prior art package for surface mounting a diode chip to a motherboard.

[0009] FIG. 2 shows the side view of FIG. 1.

[0010] FIG. 3 shows the top view of diode package with two horizontal zigzag cantilevers based on the present invention.

[0011] FIG. 4 shows the side view of FIG. 3.

[0012] FIG. 5 shows the top view of a second embodiment of the package with two inverted V-shaped horizontal cantilevers.

[0013] FIG. 6 shows the side view of FIG. 5.

[0014] FIG. 7 shows the top view of a third embodiment of a package with two vertical cantilevers.

[0015] FIG. 8 shows the side view of FIG. 7.

[0016] FIG. 9 shows the top view of a fourth embodiment of a package with two horizontal zigzag cantilevers for packaging a diode with a top electrode and a bottom electrode.

[0017] FIG. 10 shows the side view of FIG. 9.

### DETAILED DESCRIPTION OF THE INVENTION

[0018] FIG. 3 shows the top view of the first embodiment of diode package based on the present invention. A diode chip 20 is mounted on two metallic plates 21, 22. The metallic plates 21 and 22 have a rectangular cut 25 in the middle portion to form two horizontal zigzag cantilevers. The cantilevers serve as springs. When the package is subject to temperature variations, the spring action of the zigzag cantilevers can cushion the expansion and contraction stress. The chip 20 is sealed in glue 23 up to a portion of the zigzag cantilevers as shown in side view FIG. 4. The bottoms of the unsealed portions L1 and R1 of the metallic plates 21, 22 serve as contacts for surface mounting the package to a motherboard.

[0019] FIG. 5 shows the top view of a second embodiment of this invention. The diode chip 20 is mounted on two metallic plates 31, 32 as in FIG. 3. However the cut 35 in the metallic plates 31, 32 is of inverted V-shape (instead of being rectangular) to form the zigzag cantilevers. Otherwise the function of zigzag cantilevers are the same as in FIG. 3. The chip 20 is sealed in glue 23 up to a portion of the zigzag cantilevers. FIG. 6 shows the side view of FIG. 5, corresponding to FIG. 4. The bottoms of the unsealed portions L2 and R2 of the metallic plates 31, 32 serve as contacts for surface mounting the package to a motherboard.

[0020] FIG. 7 shows the top view of a third embodiment of the present invention. The diode chip 20 is mounted on two metallic plates 41, 42. The metallic plates are bent to form two vertical zigzag cantilevers 45. As in FIG. 3 and FIG. 5, the zigzag cantilevers serve as springs to cushion the stress due to temperature variations and bending. FIG. 8 shows the side view of FIG. 7. The chip 20 is sealed in glue 23 up to a portion of the zigzag cantilevers. The bottoms of the unsealed portions L3 and R3 of the metallic plates 41, 42 serve as contacts for surface mounting the package to a motherboard.

[0021] FIG. 9 shows the top view of a fourth embodiment of the present invention. The diode chip 50 has a top electrode and a bottom electrode, unlike the chip 20 in previous embodiments with two bottom electrodes. The diode chip 50 is mounted on a metallic plate 52. The top

electrode of diode chip **50** is wire-bonded by wire **56** to the second metallic plate **51**, as shown in side view **FIG. 10**. As in previous first and second embodiments, metallic plates **51** and **52** have cuts **55** to form horizontal zigzag cantilevers. The zigzag cantilevers serve as springs to cushion the stress due to temperature variations and bending. The chip **50** is sealed in glue **23** up to a portion a portion of the zigzag cantilevers. The bottoms of the unsealed portions **L4** and **R4** of the metallic plates **51** and **52** respectively serve as contacts for surface mounting the package the package to a motherboard.

[0022] While the preferred embodiments of the invention have been described, it will be apparent to those skilled in the art that various modifications may be made in the embodiments without departing from the spirit of the present invention. Such modifications are all within the scope of this invention.

1. A surface mount semiconductor device package, comprising;

a semiconductor device;

a glue for sealing said semiconductor device, and

at least two metallic plates on which said semiconductor device is mounted,

said metallic plates having bottom contacts for surface mounting to a motherboard, and zigzag cantilevers outside the chip area of said semiconductor device for strengthening said metallic plates imbedded in said glue and for making connections to said semiconductor device.

2. [A] The surface mount semiconductor device package as described in claim 1, wherein said semiconductor device is a diode.

3. [A] The surface mount semiconductor device package as described in claim 2, wherein said zigzag cantilevers [are horizontal] zigzag in a horizontal plane.

4. [A] The surface mount semiconductor device package as described in claim 3, wherein said zigzag cantilevers are of inverted-U shape.

5. [A] The surface mount semiconductor device package as described in claim 3, wherein said zigzag cantilevers are of inverted-V shape.

6. [A] The surface mount semiconductor device package as described in claim 2, wherein said zigzag cantilevers are [vertical] zigzag in a vertical plane.

7. [A] The surface mount semiconductor device package as described in claim 1, further comprising a glue to seal said semiconductor device.

8. [A] The surface mount semiconductor device package as described in claim 2, wherein said diode has two bottom electrodes.

9. [A] The surface mount semiconductor device as described in claim 2, wherein said diode has a top electrode and a bottom electrode.

10. [A] The surface mount semiconductor device as described in claim 9, wherein said bottom electrode rests on the first plate of said metallic plates and said top electrode is wire-bonded to the second plate of said metallic plates.

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