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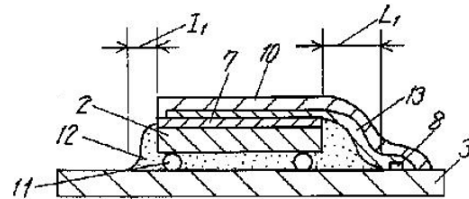
(54) [Title of the Invention] Semiconductor Device and Semiconductor Device Manufacturing Method

(57) [Abstract]

[Problem] The present invention relates to a flip chip mounted semiconductor device and provides a semiconductor device with excellent connection reliability that solves the problem of cracks readily forming in the conductive layer when subjected to sudden temperature changes or mechanical shock because a thin conductive layer for bringing the semiconductor element and the carrier substrate to the same potential is formed at a corner of the semiconductor element and the conductive layer is exposed to the outside air.

[Solution] A semiconductor element 2 having a conductive film 7 formed on the upper surface of a carrier substrate 3 having a grounding electrode 8 is flip-chip bonded, an insulating encapsulating resin 12 made, for example, of an epoxy fills the connected portion of the carrier substrate 3 and the semiconductor element 2 and the peripheral portion of the semiconductor element 2, so that the upper surface of the conductive film 7 is formed on the same plane as the upper surface of the semiconductor element 2, and so that a gradual slope is provided between the semiconductor element 2 and the grounding electrode 8 on the grounding electrode 8 side of the carrier substrate 3, and a conductive layer 13 and a protective layer 10 are formed successively on top with a uniform thickness.

2: Semiconductor element 8: Grounding electrode 12: Encapsulating resin
3: Carrier substrate 10: Protective layer 13: Conductive layer
7: Conductive film



[Claims]

[Claim 1] A semiconductor device, comprising: a carrier substrate having a grounding electrode provided on a portion of the surface; a semiconductor element flip-chip bonded to the carrier substrate; an encapsulating resin filling the connected portion between the carrier substrate and the semiconductor element and the peripheral portion of the semiconductor element; a conductive film formed on the back surface of the semiconductor element; a conductive layer electrically connecting the conductive film and the grounding electrode on the carrier substrate; and a protective layer covering the conductive layer.

[Claim 2] A semiconductor device, comprising: a carrier substrate having a plurality of land electrodes and grounding electrodes on the surface and external electrode terminals arranged in a grid pattern on the back surface; a semiconductor element including a plurality of protruding electrodes bonded by a conductive adhesive to the plurality of land electrodes on the surface of the carrier substrate; an encapsulating resin filling the connected portion between the carrier substrate and the semiconductor element and the peripheral portion of the semiconductor element; a conductive film formed on the back surface of the semiconductor element; a conductive layer electrically connecting the conductive film and the grounding electrodes on the carrier substrate; and a protective layer covering the conductive layer.

[Claim 3] The semiconductor device according to claim 1 or 2, wherein the surface of the encapsulating resin filling the peripheral portion of the semiconductor element is flush with the surface of the conductive film provided on the back surface of the semiconductor element, or is formed so as to cover a portion of the surface of the conductive film.

[Claim 4] A method for manufacturing a semiconductor device, the method comprising the steps of: flip-chip bonding a semiconductor element having a conductive film on the back surface to a carrier substrate provided with a grounding electrode; filling the connected portion of the carrier substrate and the semiconductor element and the peripheral portion of the semiconductor element with an encapsulating resin to form a fillet having a continuous gentle slope without a step from one side of the upper surface of the conductive film to the vicinity of the grounding electrode on the carrier substrate; forming a conductive layer by coating a conductive material from the upper surface of the conductive film to the upper surface of the fillet and the upper surface of the

grounding electrode on the carrier substrate; and covering the entire surface of the conductive film and the conductive layer with a protective layer made of an insulating resin.

[Claim 5] A method for manufacturing a semiconductor device, the method comprising the steps of: forming protruding electrodes on a plurality of electrodes of a semiconductor element having a conductive film on the back surface, and applying a conductive adhesive to the protruding electrodes; bonding with a conductive adhesive a plurality of land electrodes on the surface of the carrier substrate having protruding electrodes and external electrode terminals formed in a grid pattern at regular intervals on the back surface, and then heat-curing the conductive adhesive; filling the connected portion of the carrier substrate and the semiconductor element and the peripheral portion of the semiconductor element with an encapsulating resin to form a fillet having a continuous gentle slope without a step from one side of the upper surface of the conductive film to the vicinity of the grounding electrode on the carrier substrate; forming a conductive layer by coating a conductive material from the upper surface of the conductive film to the upper surface of the fillet and the upper surface of the grounding electrode on the carrier substrate; and covering the entire surface of the conductive film and the conductive layer with a protective layer made of an insulating resin.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention] The present invention relates to a semiconductor device used in industrial electronic equipment such as information and communication equipment, office electronic equipment, and medical electronic equipment, as well as in home electronic equipment, especially flip-chip mounted semiconductor devices, and a method for manufacturing this semiconductor device.

[0002]

[Prior Art] In recent years, as both industrial and consumer electronic devices have become, thinner, lighter, and more functional, various electronic components, including semiconductor elements used in these electronic equipment, have been forced as a mandatory requirement to become smaller and thinner.

[0003] In particular, significant progress has been made in semiconductor device packaging technology in the field of semiconductor equipment. Plastic quad flat packages (QFPs), which have been the mainstream multi-pin semiconductor package, have also become larger in response to the increasing functionality

and performance of electronic devices and the resulting enlargement of LSIs, and are no longer able to meet the demand for smaller and thinner electronic devices. In addition, issues have arisen related to the reliability of connections between the input/output lead wires pulled out from the sides of the plastic QFPs and circuit boards, and transmission signal delays caused by the inherent resistance of long lead pins.

[0004] In order to solve many of the problems associated with plastic QFPs, semiconductor devices called CSPs (chip size packages) have come into use, including ball grid arrays (BGAs), which replace QFP by arranging hemispherical connection terminals in a two-dimensional array on the back surface of a semiconductor package, and land grid arrays (LGAs), which arrange a large number of flat electrode pads in an array on the back surface of the package and is inserted into a socket for mounting. Both of these types of packages do not have lead pins like QFP.

[0005] These CSP semiconductors have semiconductor elements connected to a carrier substrate by face-down bonding.

[0006] The following is an explanation of a semiconductor device of the prior art with reference to the drawings. FIG. 7 is a cross-sectional view of a semiconductor device of the prior art, FIG. 8 is a plan view of this semiconductor device, and FIG. 7 is a cross-section from line C-C' in FIG. 8.

[0007] A semiconductor element 2, having protruding electrodes formed by Au bumps 1 on surface pad electrodes (not shown), is bonded to a carrier substrate 3, which is a multilayer circuit board with a ceramic insulating base, with the circuit formation surface facing downward. The upper surface of the carrier substrate 3 has a plurality of formed land electrodes 4 for electrical connection to the semiconductor element 2. These land electrodes 4 are bonded to the Au bumps 1 formed on the semiconductor element 2 by a conductive adhesive 5 previously applied to the Au bumps 1. Also, an encapsulating resin 6 fills the connected portion between semiconductor element 2 and carrier substrate 3 and the peripheral portion of semiconductor element 2.

[0008] In addition, a conductive film 7 is formed on the back surface of the semiconductor element 2, and this conductive film 7 is electrically connected to the grounding electrode 8 on the carrier substrate 3 by a conductive layer 9.

[0009]

[Problem to Be Solved by the Invention] However, in the semiconductor device of the prior art described above, the conductive layer

9, which electrically connects the conductive film 7 formed on the back surface of the semiconductor element 2 to the grounding electrode 8 on the carrier substrate 3, is exposed to the air. As a result, under conditions of sudden temperature changes or high temperatures exceeding the glass transition point of the conductive layer 9, the adhesive strength of the conductive layer 9 tends to decrease and cracks tend to occur, making it difficult to obtain a stable electrical connection between the conductive film 7 on the back surface of semiconductor element 2 and the grounding electrode on the carrier substrate 3.

[0010] Also, as shown in FIG. 8, the encapsulating resin 6 filling the connected portion between the semiconductor element 2 and the carrier substrate 3 spreads uniformly around the semiconductor element 2 with width D, and is formed at a steep angle with respect to the semiconductor element 2, as shown in the cross-sectional view in FIG. 7. Therefore, when the conductive layer 9 is applied, the thickness of the conductive layer 9 at corner E of the semiconductor element 2 is thin, resulting in a structure in which cracks are likely to occur in the conductive layer 9 at corner E when subjected to sudden temperature changes or mechanical shocks.

[0011] It is an object of the present invention to solve this problem by providing a semiconductor device that makes electrical connections easier between a conductive film provided on the back surface of a semiconductor element and a grounding electrode on a carrier substrate 3, thereby realizing excellent connection reliability.

[0012]

[Means for Solving the Problem] In order to achieve the purpose described above, the present invention provides a semiconductor device in which a semiconductor element having a conductive film on the back surface is flip-chip bonded to a carrier substrate having a grounding electrode, and the connected portion between the carrier substrate and the semiconductor element and the surrounding portion of the semiconductor element is filled with an encapsulating resin, forming a fillet having a continuous gentle slope without a step from one side of the upper surface of the conductive film to the vicinity of the grounding electrode on the carrier substrate so as to be flush with the conductive film or cover one side of its surface, making the upper surface of the conductive film and the upper surface of the fillet smooth without steps or corners. After applying a conductive layer from a portion of the surface of the conductive film to the upper

surface of the fillet and the upper surface of the grounding electrode on the carrier substrate, a protective layer composed of an insulating resin is applied over the entire surface of the conductive film and the conductive layer.

[0013]

[Embodiment of the Invention] The invention according to claim 1 of the present invention is a semiconductor device, comprising: a carrier substrate having a grounding electrode provided on a portion of the surface; a semiconductor element flip-chip bonded to the carrier substrate; an encapsulating resin filling the connected portion between the carrier substrate and the semiconductor element and the peripheral portion of the semiconductor element; a conductive film formed on the back surface of the semiconductor element; a conductive layer electrically connecting the conductive film and the grounding electrode on the carrier substrate; and a protective layer covering the conductive layer. This can prevent a decrease in the adhesive strength of the conductive layer or the occurrence of cracks in the conductive layer under conditions of rapid temperature changes or high temperatures exceeding the glass transition point of the conductive layer, thereby improving the reliability of the electrical connections between the conductive film provided on the back surface of the semiconductor element and the grounding electrode on the carrier substrate.

[0014] The invention according to claim 2 of the present invention is a semiconductor device, comprising: a carrier substrate having a plurality of land electrodes and grounding electrodes on the surface and external electrode terminals arranged in a grid pattern on the back surface; a semiconductor element including a plurality of protruding electrodes bonded by a conductive adhesive to the plurality of land electrodes on the surface of the carrier substrate; an encapsulating resin filling the connected portion between the carrier substrate and the semiconductor element and the peripheral portion of the semiconductor element; a conductive film formed on the back surface of the semiconductor element; a conductive layer electrically connecting the conductive film and the grounding electrodes on the carrier substrate; and a protective layer covering the conductive layer. As a result, the same effect as in claim 1 can be obtained.

[0015] The invention according to claim 3 of the present invention is the semiconductor device according to claim 1 or 2, wherein the surface of the encapsulating resin filling the peripheral portion of the semiconductor element is flush with the surface of the conductive film provided

on the back surface of the semiconductor element, or is formed so as to cover a portion of the surface of the conductive film. By forming a gentle slope without corners in the connected portion between the conductive film and the encapsulating resin, the thickness of the conductive layer can be made uniform, thereby preventing cracks and other defects from occurring due to sudden temperature changes or mechanical shocks, and enabling excellent connection reliability.

[0016] The invention according to claim 4 of the present invention is a method for manufacturing a semiconductor device, the method comprising the steps of: flip-chip bonding a semiconductor element having a conductive film on the back surface to a carrier substrate provided with a grounding electrode; filling the connected portion of the carrier substrate and the semiconductor element and the peripheral portion of the semiconductor element with an encapsulating resin to form a fillet having a continuous gentle slope without a step from one side of the upper surface of the conductive film to the vicinity of the grounding electrode on the carrier substrate; forming a conductive layer by coating a conductive material from the upper surface of the conductive film to the upper surface of the fillet and the upper surface of the grounding electrode on the carrier substrate; and covering the entire surface of the conductive film and the conductive layer with a protective layer made of an insulating resin. As a result, a semiconductor device with excellent electrical connection reliability can be formed.

[0017] The invention according to claim 5 of the present invention is a method for manufacturing a semiconductor device, the method comprising the steps of: forming protruding electrodes on a plurality of electrodes of a semiconductor element having a conductive film on the back surface, and applying a conductive adhesive to the protruding electrodes; bonding with a conductive adhesive a plurality of land electrodes on the surface of the carrier substrate having protruding electrodes and external electrode terminals formed in a grid pattern at regular intervals on the back surface, and then heat-curing the conductive adhesive; filling the connected portion of the carrier substrate and the semiconductor element and the peripheral portion of the semiconductor element with an encapsulating resin to form a fillet having a continuous gentle slope without a step from one side of the upper surface of the conductive film to the vicinity of the grounding electrode on the carrier substrate; forming a conductive layer by coating a conductive material from the upper surface of the

conductive film to the upper surface of the fillet and the upper surface of the grounding electrode on the carrier substrate; and covering the entire surface of the conductive film and the conductive layer with a protective layer made of an insulating resin. As a result, the same effect as in claim 4 can be obtained.

[0018] Embodiments of the present invention will now be described with reference to the drawings, using the same reference numbers for the same elements as those in FIG. 7 and FIG. 8.

[0019] FIG. 1 is a cross-sectional view of the semiconductor device in the first embodiment of the present invention, and FIG. 2 is a plan view of the same semiconductor device. FIG. 1 is a cross-section of the portion along line A-A' in FIG. 2.

[0020] As shown in FIG. 1, a semiconductor element 2 is connected to the upper surface of a carrier substrate 3 with a grounding electrode 8 by face-down bonding via solder balls 11. A conductive film 7 is formed on the back surface of the semiconductor element 2 to bring the semiconductor element 2 to the same potential as the carrier substrate 3. An insulating encapsulating resin 12 made, for example, of an epoxy resin fills the connected portion between the carrier substrate 3 and the semiconductor element 2 and around the semiconductor element 2.

[0021] At this time, the encapsulating resin 12, which is a feature of the present invention, is added so as to be flush with the upper surface of the conductive film 7 provided on the back surface of the semiconductor element 2, as shown in FIG. 1, and the grounding electrode 8 is formed on the grounding electrode 8 side of the carrier substrate 3 with a width wider than on the semiconductor element side opposite the grounding electrode 8 so as to provide a gentle slope between the semiconductor element 2 and the grounding electrode 8. As shown in FIG. 1 and FIG. 2, the width L_1 of the fillet on the grounding electrode 8 side is wider than the width l_1 of the fillet on the opposite side. Therefore, the shape of the upper surface of the fillet formed by the encapsulating resin 12 on the upper surface of the conductive film 7 and the grounding electrode 8 side has a continuous gentle slope in cross section, and there is no corner E as shown in the structure of the prior art in FIG. 7.

[0022] Next, a conductive layer 13 is formed from the upper surface of the conductive film 7 to the upper surface of the encapsulating resin 12 to bring the semiconductor element 2 and the carrier substrate 3 to the same potential, thereby connecting them to the grounding

electrode 8. A protective layer 10 composed of an insulating resin is applied to protect the conductive layer 13 and the conductive film 7 from corrosion by atmospheric air, and completing the semiconductor device according to the present invention.

[0023] As can be seen from FIG. 1, the conductive layer 13 is formed without a step on the surface of the encapsulating resin 12 having a gentle slope for the fillet, which is on the upper surface of the conductive film 7, so that the coating thickness is uniform. Because there are no corners that could cause a concentration of stress and lead to cracks or other type of failure, the device has sufficient shock absorption capacity to withstand sudden temperature changes, high temperatures exceeding the glass transition point of the conductive layer 13, and mechanical shocks. Also, because the conductive layer 13 is covered by an insulating protective layer 10 over its entire exposed surface, it is corrosion-resistant even when exposed to air or harmful gases in the operating environment, thereby providing excellent electrical connection reliability.

[0024] Note that in the embodiment described above, FIG. 1 depicts an example in which a fillet formed from the encapsulating resin 12 is formed on the surface of the conductive film 7 in a continuous surface without any step. However, the fillet can overlap with one side of the surface of the conductive film 7, thereby achieving the same effect.

[0025] Next, the second embodiment of the present invention will be described with reference to FIG. 3 and FIG. 4. FIG. 3 is a cross-sectional view of the semiconductor device in the present embodiment, and FIG. 4 is a plan view of the same semiconductor device. FIG. 3 shows a cross section from line B-B' in FIG. 4.

[0026] As shown in FIG. 3, a semiconductor element 2, which has a protruding electrode 1 such as an Au bump on a surface pad electrode (not shown) and a conductive film 7 formed on the back surface, is bonded to a carrier substrate 3, which is a multilayer circuit board composed of a ceramic insulator, with the surface side facing down. The upper surface of the carrier substrate 3 has a plurality of formed land electrodes 4 for connecting to pad electrodes on the surface of the semiconductor element 2, and these land electrodes 4 are bonded to the Au bumps 1 formed on the semiconductor element 2 by a conductive adhesive 5.

[0027] The connected portion between the joined semiconductor element 2 and the carrier substrate 3, as well as the surrounding portion of the semiconductor element 2, are filled with

an encapsulating resin 12 made, for example, of an epoxy resin.

[0028] The encapsulating resin 12 in the present embodiment is the same as that described in the first embodiment, and is added so as to become flush with the upper surface of the conductive film 7 provided on the back surface of the semiconductor element 2, and so as to have a gentle slope between the semiconductor element 2 and the grounding electrode 8 on the carrier substrate 3.

[0029] Thus, as shown in FIG. 3 and FIG. 4, the width L_2 of the fillet formed on the grounding electrode 8 side is larger than the width l_2 of the fillet on the opposite side, and the upper surface of the fillet, which is formed by the conductive film 7 and the encapsulating resin 12, has a continuous, gentle slope without any steps in cross section, thereby preventing the formation of sharp corners that could serve as initiation points for fractures, as seen in prior art structures.

[0030] Next, a conductive layer 13 for bringing the semiconductor element 2 and the carrier substrate 3 to the same potential is formed from the upper surface of the conductive film 7 to the upper surface of the fillet so as to be flush, thereby connecting to the grounding electrode 8. Next, a protective layer 10 made of an insulating resin is applied to protect the conductive layer 13 and the conductive film 7 from corrosion by the atmosphere, and complete the semiconductor device of the present embodiment.

[0031] As clearly shown in FIG. 3, the conductive layer 13 is formed on the surface of the encapsulating resin 12 having the gentle slope of the fillet, which is continuously flush with the upper surface of the conductive film 7 on the grounding electrode 8 side of the carrier substrate 3, without any step, thereby ensuring a uniform coating thickness and eliminating corners that could cause concentrations of stress that lead to failure. This has sufficient shock absorption capacity to withstand sudden temperature changes, large thermal shocks in high-temperature environments above the glass transition point of conductive layer 13, and mechanical shocks. Also, because the conductive layer 13 is covered by an insulating protective layer 10 over its entire exposed surface, it is corrosion-resistant even when exposed to air or harmful gases in the operating environment, thereby providing excellent electrical connection reliability.

[0032] Next, the method for manufacturing a semiconductor device in the present invention will be described using the semiconductor device in the second embodiment as an example.

FIG. 5 (a) to FIG. 5 (d) show the first half of the manufacturing method, and FIG. 6 (a) and FIG. 6 (b) show the second half.

[0033] First, as shown in FIG. 5 (a), Au bumps 1 having a two-step protruding shape are formed as protruding electrodes on pad electrodes 16 of the semiconductor element 2 using the ball bonding method. Specifically, a ball formed at the tip of an Au wire is thermally bonded to an aluminum pad electrode 16 formed on the semiconductor element 2 to form the lower portion of the two-stage protrusion, and the upper portion of the two-stage protrusion is formed by moving a capillary 14 to form an Au wire loop. Next, in order to make the height of the two-step protrusion shape of the Au bumps 1 uniform, pressure is applied to the top to flatten the top and make the height uniform.

[0034] Next, the semiconductor element 2 with Au bumps 1, which were formed using a conductive adhesive 5 comprising Ag-Pd as a conductive material and epoxy resin as a binder and applied at an appropriate thickness using the doctor blade method on a rotating disk, are pressed and then lifted, to transfer the conductive adhesive 5 to the upper surface of the Au bumps 1, as shown in FIG. 5 (b).

[0035] Next, as shown in FIG. 5 (c), the semiconductor element 2 is placed on the carrier substrate 3 with the surface with the Au bumps 1 and the conductive adhesive 5 facing downwards, and external electrode terminals 15 are formed in a grid pattern on the back surface. The carrier substrate 3 is then flip-chip bonded so that the land electrodes 4 on the carrier substrate 3 are aligned with the Au bumps 1, and the conductive adhesive 5 is thermally cured at a constant temperature.

[0036] Next, as shown in FIG. 5 (d), the epoxy-based encapsulating resin 12 is injected into the connected portion between the semiconductor element 2 and the carrier substrate 3 from the grounding electrode 8 side of the carrier substrate 3, while simultaneously raising the resin around the peripheral portion of the semiconductor element 2. By filling the resin to be flush with the surface of the conductive film 7 on the semiconductor element 2 or slightly overlapping a portion of the surface of the conductive film 7, a fillet with a width of L_2 and a gentle slope is formed on the grounding electrode 8 side. Also, by injecting the encapsulating resin 12 from the grounding electrode 8 side, a fillet having a narrow width l_2 is formed on the carrier substrate 3 opposite to the grounding electrode 8.

[0037] The encapsulating resin 12 used here can be an epoxy resin to which a high thermal

conductivity ceramic such as aluminum nitride (AlN) or silicon nitride (SiN) has been added as a filler.

[0038] Next, as shown in FIG. 6 (a), a conductive adhesive containing a conductive material such as Ag-Pd is applied using an injection nozzle, etc. from the upper surface of the conductive film 7 of the semiconductor element 2 over the fillet surface with a gentle slope formed by the encapsulating resin 12 to the upper surface of the grounding electrode 8 on the carrier substrate 3 and then cured to form a conductive layer 13.

[0039] Next, as shown in FIG. 6 (b), a protective layer 10 made of an insulating resin is applied using an injection nozzle, etc. to completely cover the upper surface of the conductive film 7 and the exposed surface of the conductive layer 13 and then cured to complete the semiconductor device of the present invention.

[0040] Because the conductive layer 13 is formed along the surface of the fillet with a gentle slope formed by the encapsulating resin 12 flush with the surface of the conductive film 7 and the surface of the conductive film 7, the corners of semiconductor element 2 do not protrude into the conductive layer 13, and the conductive layer 13 can be formed with a uniform thickness on a surface that is continuous with the surface of the fillet with a gentle slope from the surface of conductive film 7. In this way, a large shock-absorbing force can be provided against the occurrence of cracks, etc. Also, because the conductive layer 13 is covered by a protective layer 10 over its entire surface, corrosion by the outside air can be prevented.

[0041]

[Effect of the Invention] As is clear from the embodiments described above, the present invention provides a semiconductor device in which the connected portion between a flip-chip bonded carrier substrate and a semiconductor element and the surrounding portion of the semiconductor element is filled with an encapsulating resin, forming a fillet having a continuous gentle slope without a step from one side of the upper surface of the conductive film to the vicinity of the grounding electrode on the carrier substrate so as to be flush with the

conductive film or cover one side of its surface, making the upper surface of the conductive film and the upper surface of the fillet smooth without steps or corners. After applying a conductive layer from a portion of the surface of the conductive film to the upper surface of the fillet and the upper surface of the grounding electrode on the carrier substrate, a protective layer composed of an insulating resin is applied over the entire surface of the conductive film and the conductive layer. This can prevent a decrease in the adhesive strength of the conductive layer or the occurrence of cracks in the conductive layer under conditions of rapid temperature changes or high temperatures exceeding the glass transition point of the conductive layer, thereby improving the reliability of the electrical connections between the conductive film provided on the back surface of the semiconductor element and the grounding electrode on the carrier substrate.

[Brief Description of the Drawings]

[FIG. 1] FIG. 1 is a cross-sectional view of the semiconductor device in the first embodiment of the present invention.

[FIG. 2] FIG. 2 is a plan view of the same semiconductor device.

[FIG. 3] FIG. 3 is a cross-sectional view of the semiconductor device in the second embodiment of the present invention.

[FIG. 4] FIG. 4 is a plan view of the same semiconductor device.

[FIG. 5] FIG. 5 (a) to FIG. 5 (d) are diagrams used to explain the first half of the method for manufacturing the semiconductor device in the second embodiment of the present invention.

[FIG. 6] FIG. 6 (a) and FIG. 6 (b) are diagrams used to explain the second half of same manufacturing method.

[FIG. 7] FIG. 7 is a cross-sectional view of a semiconductor device of the prior art.

[FIG. 8] FIG. 8 is a plan view of the same semiconductor device.

[Reference Numbers]

2: Semiconductor element

3: Carrier substrate

7: Conductive film

8: Grounding electrode

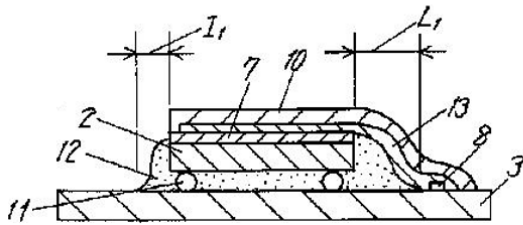
10: Protective layer

12: Encapsulating resin

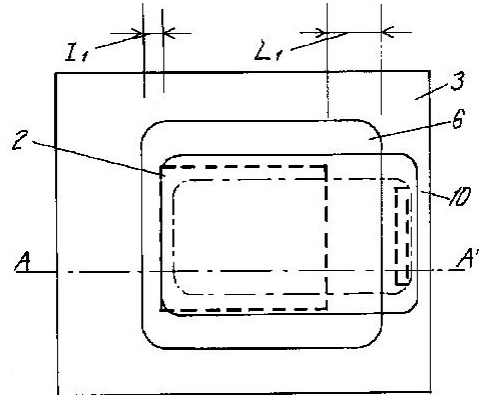
13: Conductive layer

[FIG. 1]

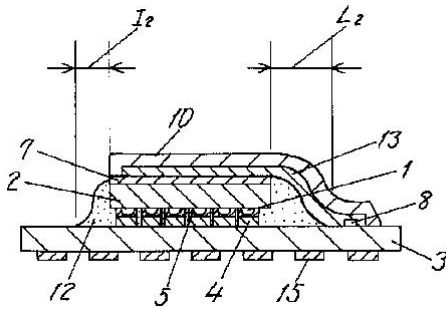
2: Semiconductor element 8: Grounding electrode 12: Encapsulating resin
 3: Carrier substrate 10: Protective layer 13: Conductive layer
 7: Conductive film



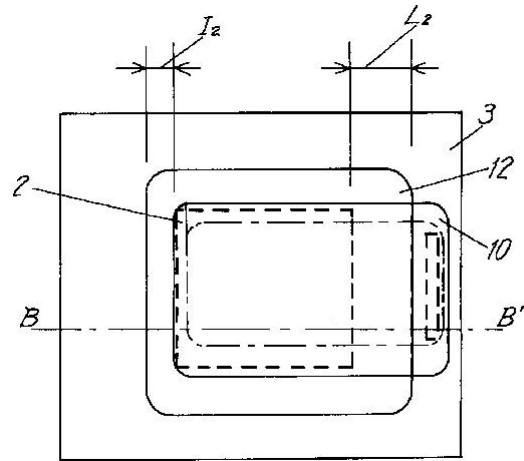
[FIG. 2]



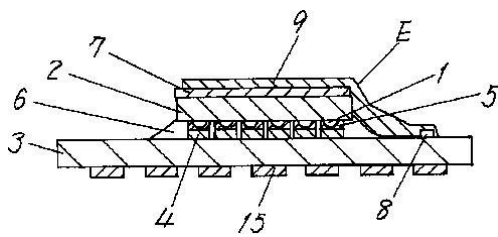
[FIG. 3]



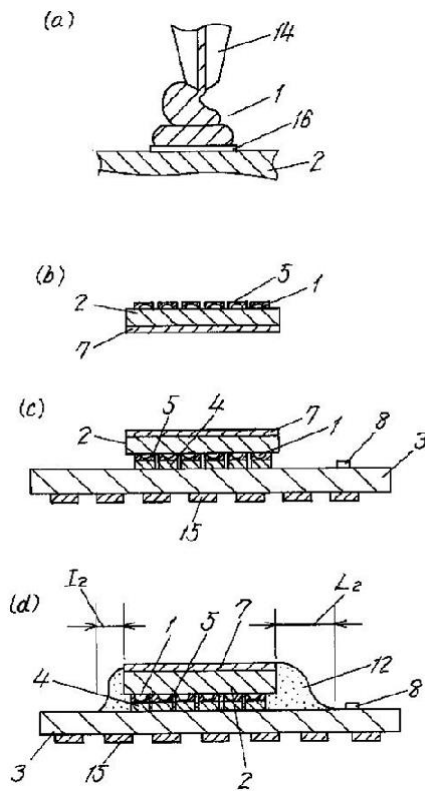
[FIG. 4]



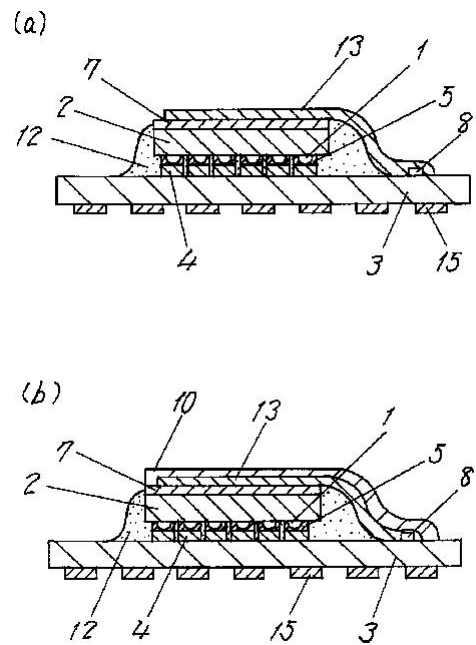
[FIG. 7]



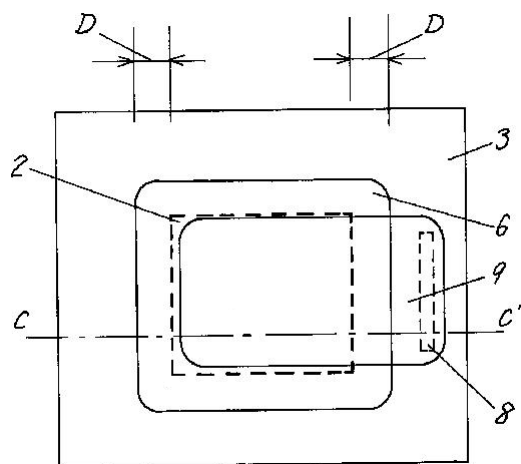
[FIG. 5]



[FIG. 6]



[FIG. 8]





TRANSLATION CERTIFICATION

Date: June 30, 2025

To whom it may concern:

I, Frank McGee, am fluent in the Japanese and English languages and I personally performed this translation. I am fluent in the Spanish and English languages, and I solemnly and sincerely declare that the following is, to the best of my knowledge and belief, a true and correct translation of JP2001007257A.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

The document is designated as:

- JP2001007257A

Frank McGee

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