US 20020005579A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2002/0005579 A1**

YAMADA (43) **Pub. Date: Jan. 17, 2002**

(54) **SEMICONDUCTOR APPARATUS AND FRAME USED FOR FABRICATING THE SAME**

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(*) Notice: This is a publication of a continued prosecution application (CPA) filed under 37 CFR 1.53(d).

(21) Appl. No.: **09/276,118**

(22) Filed: **Mar. 25, 1999**

(30) **Foreign Application Priority Data**

Aug. 18, 1998 (JP) H10-232127

Publication Classification

(51) **Int. Cl.**[7] **H01L 23/495**; H01L 23/48; H01L 23/52; H01L 29/40

(52) **U.S. Cl.** **257/734**

(57) **ABSTRACT**

A semiconductor apparatus includes an insulation tape provided with a device hole therein and a semiconductor chip mounted in the device hole and is provided at a first surface with electrode pads. The apparatus also includes a wiring pattern including leads connected at one ends to the electrode pads; and a heat-radiation member provided on the first surface of the semiconductor chip so that heat generated in the semiconductor chip is radiated outwardly through the heat-radiation member.

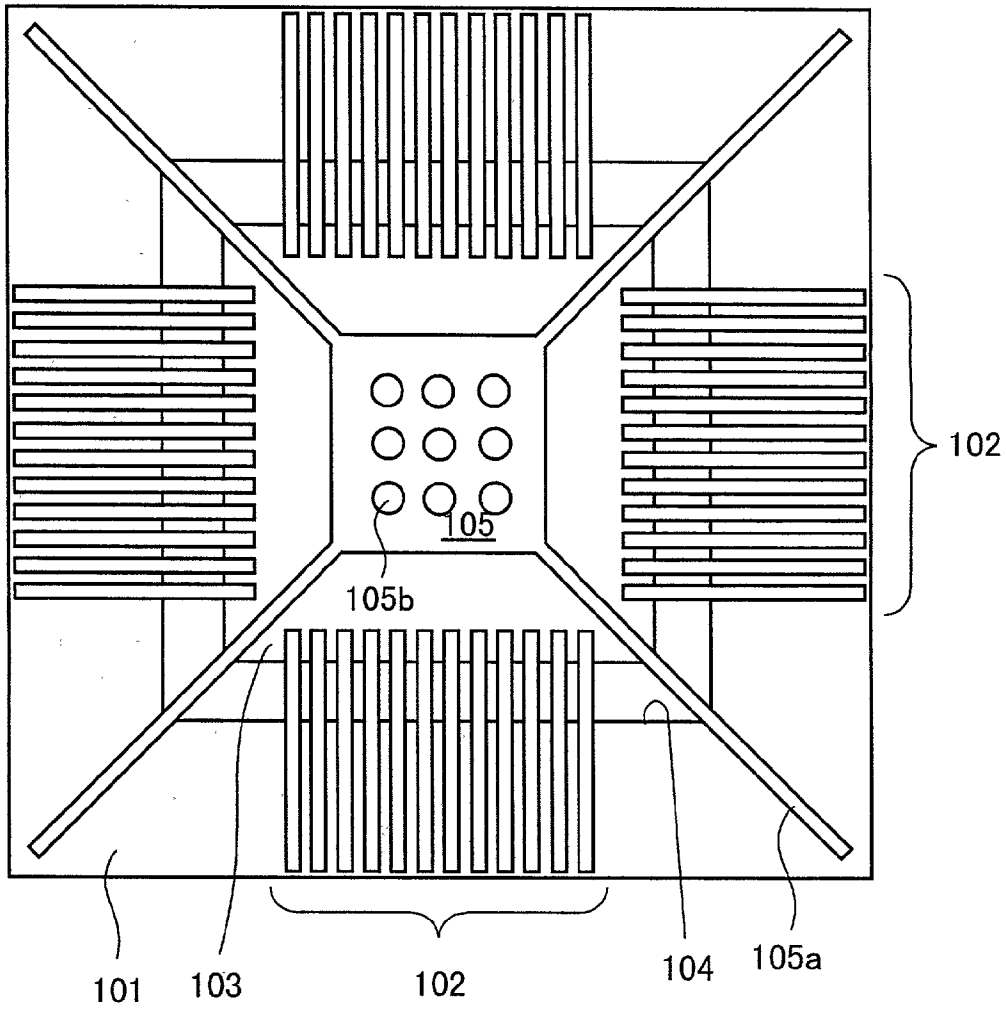


FIG. 1A (Prior Art)

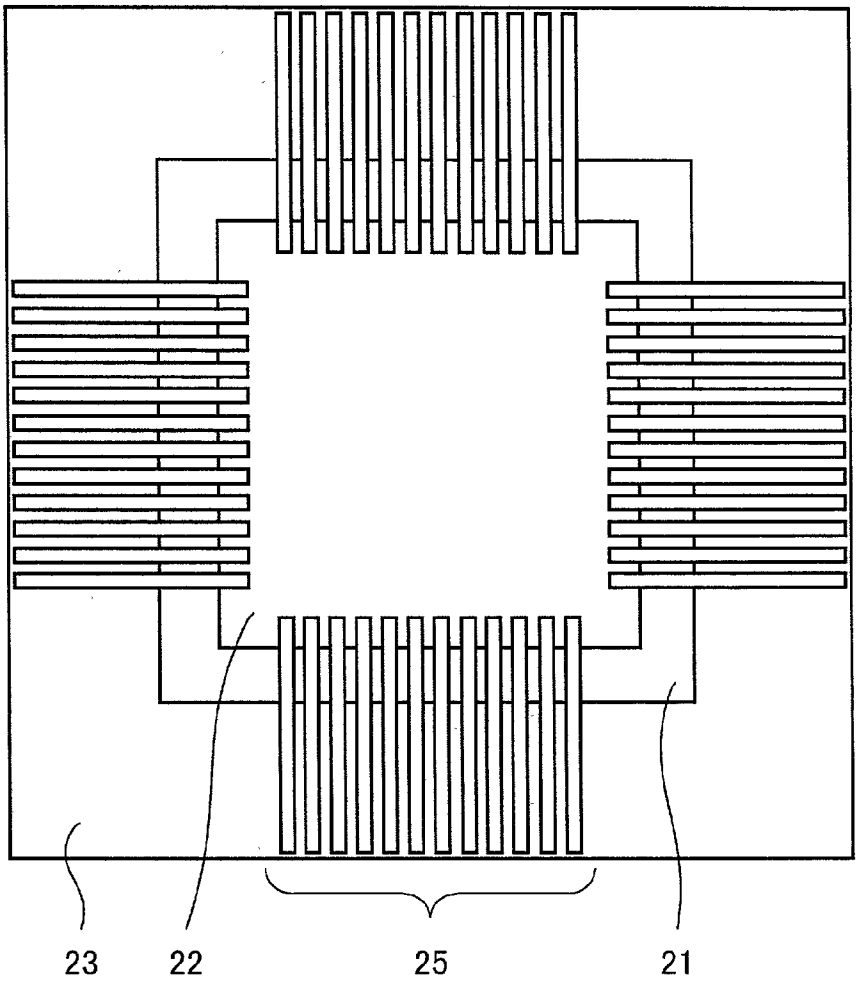


FIG. 1B (Prior Art)

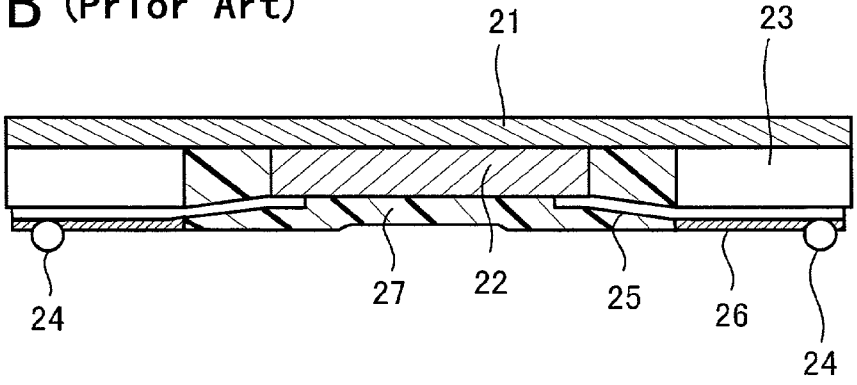


FIG. 2A

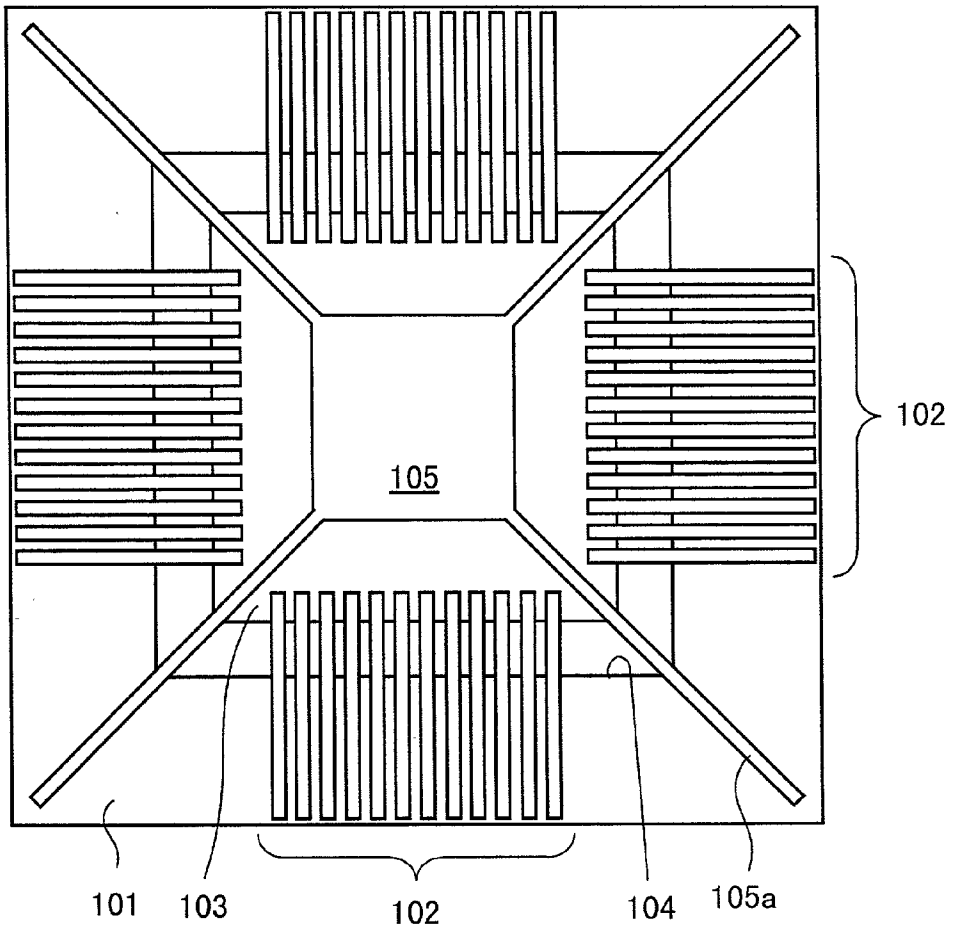

102
105
101
103
102
104
105a

FIG. 2B

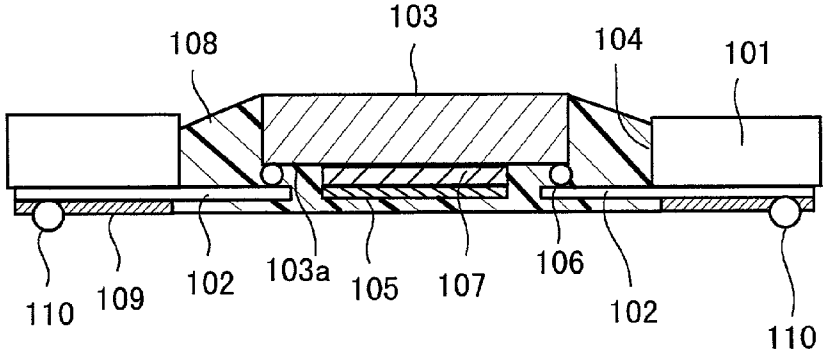

103
108
104
101
110
109
102
103a
105
107
106
102
110

FIG. 3

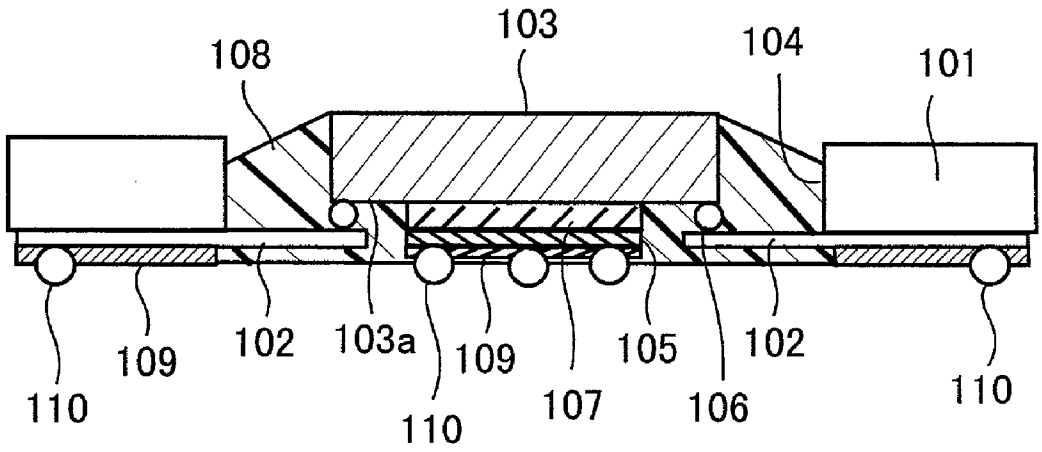


FIG. 4A

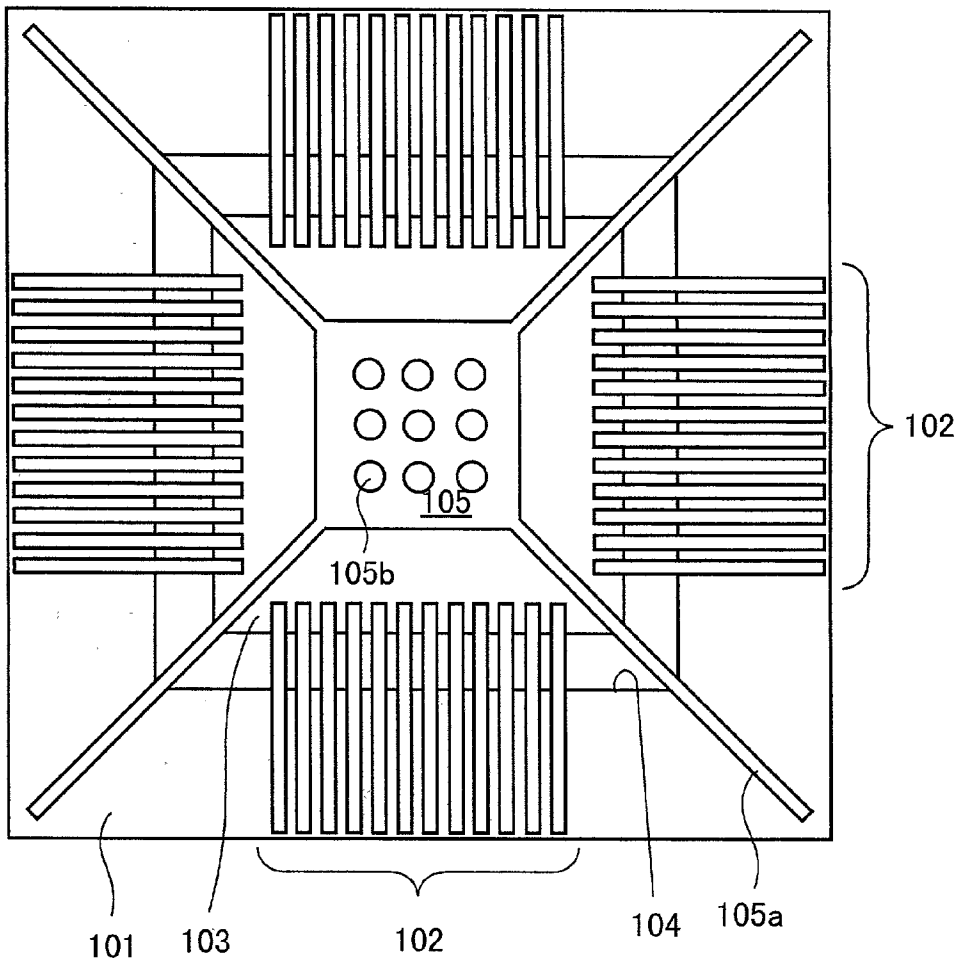

102
105
105b
101
103
102
104
105a

FIG. 4B

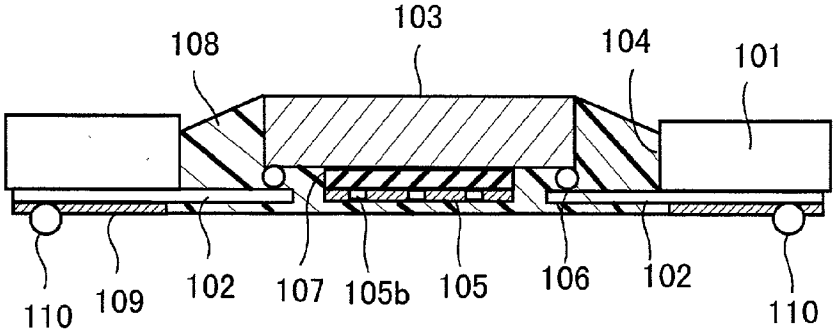

103
108
104
101
110
109
102
107
105b
105
106
102
110

FIG. 5A

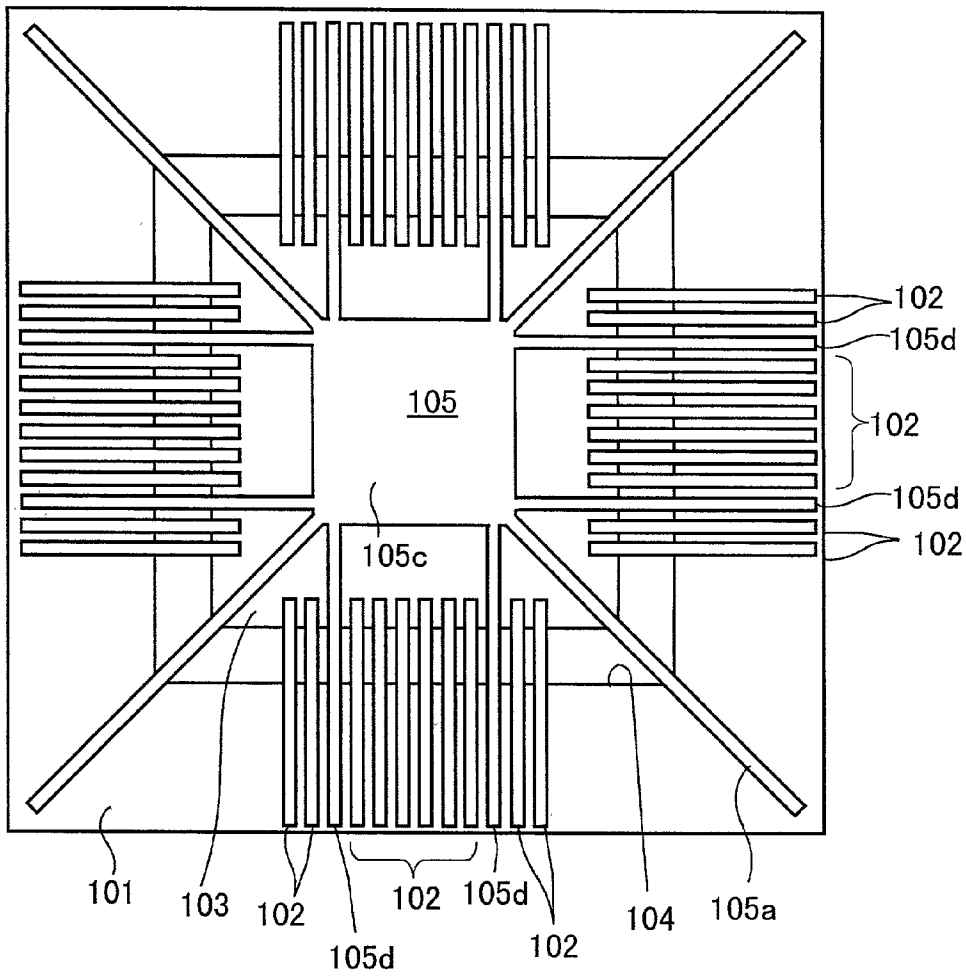

102
105d
105
102
105d
105c
102
101
103
102
102
105d
105d
102
104
105a

FIG. 5B

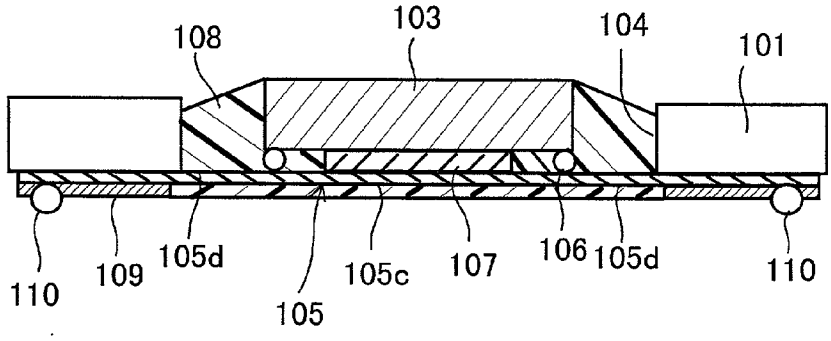
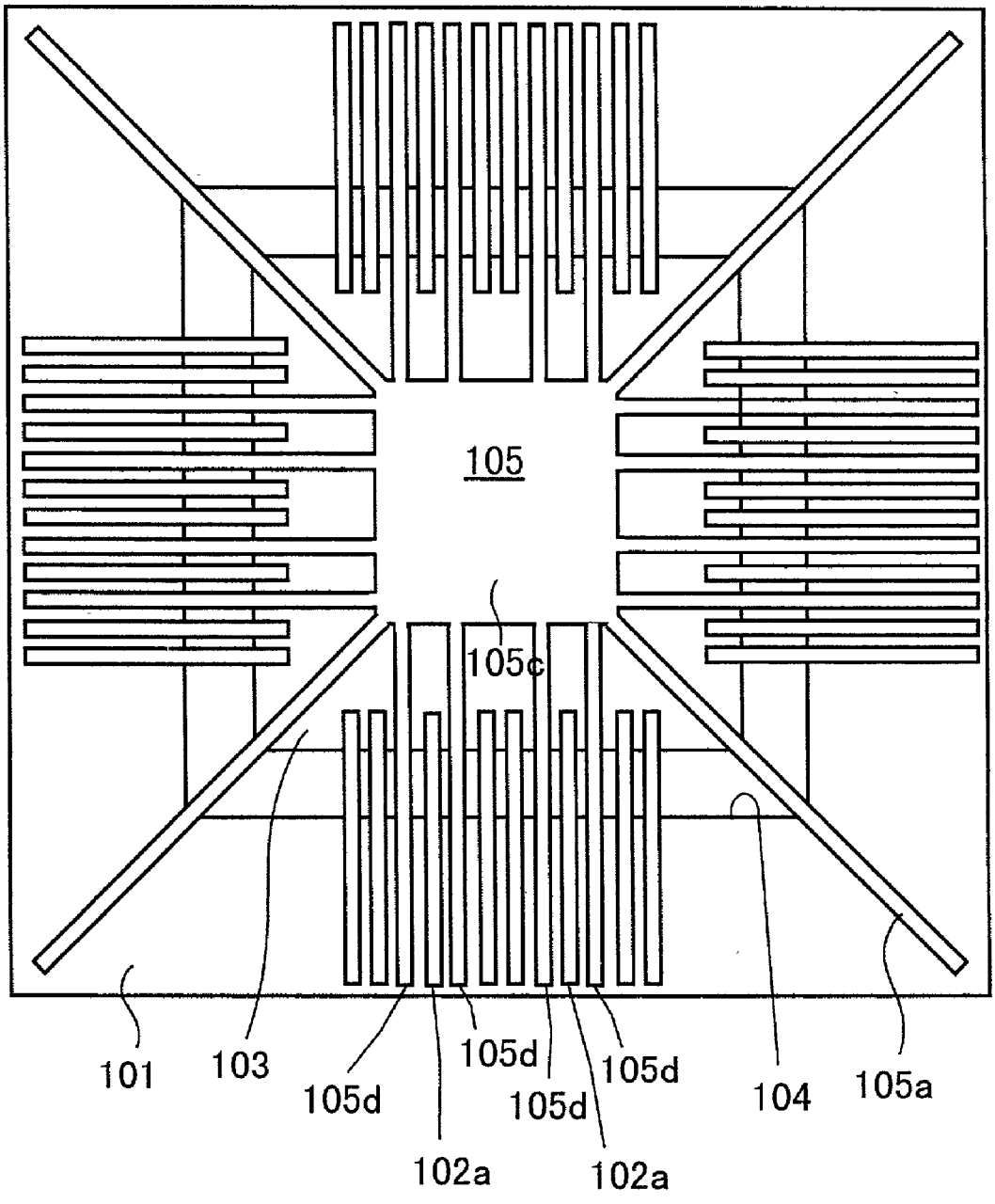

108
103
104
101
110
109
105d
105
105c
107
106
105d
110

FIG. 6



SEMICONDUCTOR APPARATUS AND FRAME USED FOR FABRICATING THE SAME

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the priority of Application No. H10-232127, filed Aug. 18, 1998 in Japan, the subject matter of which is incorporated herein by reference.

TECHNICAL FIELD OF THE INVENTION

[0002] The present invention relates to a semiconductor apparatus, and more particularly to a heat-radiating mechanism for a semiconductor package.

BACKGROUND OF THE INVENTION

[0003] A conventional semiconductor apparatus is described in Japanese Patent Laying Open Kokai No. H6-78574. The conventional semiconductor apparatus includes a package substrate, a semiconductor chip mounted on a surface of the package substrate, an elastic layer and a wiring pattern. The elastic layer is made of insulating material and is formed to surround the semiconductor chip. A film including the wiring pattern and a base film is formed on the semiconductor chip and the elastic layer. The wiring pattern includes leads connected at one ends to the semiconductor chip and at the other ends to outer terminals, which are provided on the elastic layer. The semiconductor chip is provided in an opening of the elastic layer, and is molded with resin by potting process.

[0004] In the above described conventional semiconductor apparatus, the semiconductor chip is arranged between the package substrate and the molding resin, so that heat generated in the semiconductor chip is not radiated enough. As a result, the semiconductor chip is over heated, and therefore, performance and reliability of the semiconductor chip may be deteriorated.

OBJECTS OF THE INVENTION

[0005] Accordingly, an object of the present invention is to provide a semiconductor apparatus in which a semiconductor chip is prevented from over heating.

[0006] Another object of the present invention is to provide a frame, used for fabricating a semiconductor apparatus, in which a semiconductor chip is prevented from over heating.

[0007] Additional objects, advantages and novel features of the present invention will be set forth in part in the description that follows, and in part will become apparent to those skilled in the art upon examination of the following or may be learned by practice of the invention. The objects and advantages of the invention may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

SUMMARY OF THE INVENTION

[0008] According to a first aspect of the present invention, a semiconductor apparatus includes an insulation tape which is provided with a device hole therein; and a semiconductor chip which is mounted in the device hole of the insulation tape and is provided at a first surface with electrode pads. The semiconductor apparatus also includes a wiring pattern which comprises leads connected at one ends to the electrode pads; and a heat-radiation member which is provided on the first surface of the semiconductor chip so that heat generated in the semiconductor chip is radiated outwardly via the heat-radiation member.

[0009] According to a second aspect of the present invention, a frame includes an insulation tape which is provided with a device hole, in which a semiconductor chip is mounted; and a wiring pattern which includes leads connected at one ends to electrode pads, provided on a first surface of the semiconductor chip. The frame also includes a heat-radiation member which is provided on the first surface of the semiconductor chip so that heat generated in the semiconductor chip is outwardly radiated via the heat-radiation member.

[0010] As described above, according to the present invention, heat generated in the semiconductor chip is radiated through the heat-radiation member. As a result, the heat-radiation rate of the semiconductor chip is increased, and therefore, the semiconductor chip is prevented from over heating.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] **FIG. 1A** is a plane view illustrating a conventional semiconductor apparatus in a condition before a resin molding process.

[0012] **FIG. 1B** is a cross-sectional view illustrating the conventional semiconductor apparatus, shown in **FIG. 1A**, in a condition after the resin molding process.

[0013] **FIG. 2A** is a plane view illustrating a semiconductor apparatus, according to a first preferred embodiment of the present invention, in a condition before a resin molding process.

[0014] **FIG. 2B** is a cross-sectional view illustrating the semiconductor apparatus, shown in **FIG. 2A**, in a condition after the resin molding process.

[0015] **FIG. 3** is a cross-sectional view illustrating a semiconductor apparatus, according to a second preferred embodiment of the present invention.

[0016] **FIG. 4A** is a plane view illustrating a semiconductor apparatus, according to a third preferred embodiment of the present invention, in a condition before a resin molding process.

[0017] **FIG. 4B** is a cross-sectional view illustrating the semiconductor apparatus, shown in **FIG. 4A**, in a condition after the resin molding.

[0018] **FIG. 5A** is a plane view illustrating a semiconductor apparatus, according to a fourth preferred embodiment of the present invention, in a condition before a resin molding process.

[0019] **FIG. 5B** is a cross-sectional view illustrating the semiconductor apparatus, shown in **FIG. 5A**, in a condition after the resin molding process.

[0020] **FIG. 6** is a plane view illustrating a semiconductor apparatus according to a fifth preferred embodiment of the present invention.

DETAILED DISCLOSURE OF THE INVENTION

[0021] For better understanding of the present invention, a conventional technology is first described. **FIGS. 1A and**

1B depict a conventional semiconductor apparatus in conditions before and after resin molding process, respectively. Such a conventional semiconductor apparatus is described in Japanese Patent Laying Open Kokai No. H6-78574.

[**0022**] The conventional semiconductor apparatus includes a package substrate **21**, a semiconductor chip **22**, an elastic layer **23** and a wiring pattern **25**. The semiconductor chip **22** is mounted on a surface of the package substrate **21**. The elastic layer **23** is made of insulating material and is formed to surround the semiconductor chip **22**. A film, including the wiring pattern and a base film **26**, is formed on the semiconductor chip **22** and the elastic layer **23**. The wiring pattern **25** includes leads connected at one ends to connecting portions of the semiconductor chip **22** and at the other ends to outer terminals **24**, which are provided on the elastic layer **23**. The base film **26** is shaped to be square to cover the elastic layer **23**. The semiconductor chip **22** provided in an opening of the elastic layer **23** is molded with resin **27** using a potting equipment.

[**0023**] In the above described conventional semiconductor apparatus, the semiconductor chip **22** is arranged between the package substrate **21** and the molding resin **27**, so that heat generated in the semiconductor chip is not radiated enough. As a result, the semiconductor chip **22** is over heated, and therefore, performance and reliability of the semiconductor chip **22** may be deteriorated. In general, a semiconductor chip generates much heat at a surface on which electrodes are formed. According to the above mentioned conventional semiconductor apparatus, the surface is covered with the molding resin **27**, therefore heat can not be radiated well. On the other hand, heat generated in the semiconductor chip **22** can be radiated through itself, however, enough heat can not be transferred to the substrate **21**.

[**0024**] **FIGS. 2A and 2B** show a TCP (Tape Carrier Package) type of semiconductor apparatus, according to a first preferred embodiment of the present invention. In this application, TCP means a package fabricated using TAB (Tape Automated Bonding) technology, including a T-BGA (Tape Ball Grid Allay). That is, the invention is applicable to semiconductor apparatus fabricated using BGA (Ball Grid Allay) technique.

[**0025**] An insulation tape **101** is made of material having electrical insulation characteristic, such as polyimide, and is shaped to be square. The insulation tape **101** is provided with a device hole **104** in which a semiconductor chip **103** is mounted. The insulation tape **101** is provided at a surface with a wiring pattern **102** made of conductive material, such as copper.

[**0026**] The wiring pattern **102** includes leads extending perpendicular to each side of the device hole **104**. One ends of the leads are connected via bumps **106** to electrode pads of the semiconductor chip **103**, and the other ends are connected to outer terminals **110**.

[**0027**] A heat-radiation pattern **105** is provided on a surface **103***a* of the semiconductor chip **103** where the electrode pads are arranged on. The heat-radiation pattern **105** is shaped to be square and is in contact with the surface **103***a* with an adhesive layer **107**. The heat-radiation pattern **105** is provided at each corner with a support member **106***a*, which extend outwardly. Each support member **105***a* is connected to the insulation tape **101**.

[**0028**] The insulation tape **101**, the wiring pattern **102** and the heat-radiation pattern **105** form a frame. The wiring pattern **102** and the heat-radiation pattern **105** are integrally made of conductive material, such as copper. The frame is used for TAB (Tape Automated Bonding). For fabricating the frame, two-layer structure or three-layer structure can be used. The two-layer structure includes an insulation tape and a conductive layer. The three-layer structure includes an adhesive layer between the insulation tape and the conductive layer.

[**0029**] When the two-layer structure is applied to the first preferred embodiment of the present invention, a metal layer is formed on an insulation tape by chemical plating or sputtering technique. Next, a resist layer is patterned on the metal layer by photolithography technique. Then, the wiring pattern and the heat-radiation pattern of copper are formed by electrolytic plating using the resist layer as a mask.

[**0030**] The room surrounding the semiconductor chip **103** in the device hole **104** is filled up with a molding resin **108**. The wiring pattern **102** is covered at the portions extending into the device hole **104** with the molding resin **108**. The heat-radiation pattern **105** is also covered with the molding resin **108**. An insulating layer **109** is provided at the portions of the wiring pattern **102**, connected to the insulation tape **101**. The insulating layer **109** is not provided at the portions where the outer terminals **110** are connected.

[**0031**] In the above described semiconductor apparatus according to the first preferred embodiment of the present invention, when fabrication, the outer terminals **110** are connected to a wiring pattern of a substrate, not shown. Outer circuitry on the substrate are connected to the inner circuitry of the semiconductor chip **103** via the outer terminals **110**, the wiring pattern **102** and the bumps **106**.

[**0032**] The semiconductor chip **103** is exposed at the other (upper) surface, so that heat generated in the semiconductor chip **103** is directly radiated from the upper surface, as shown in **FIG. 2B**. Heat generated in the semiconductor chip **103** is radiated through the heat-radiation pattern **105** to the air and to the substrate. Consequently, heat of the semiconductor chip **103** is well radiated to outside, and therefore over heating of the semiconductor chip can be prevented.

[**0033**] **FIG. 3** shows a semiconductor apparatus according to a second preferred embodiment of the present invention. In **FIG. 3**, the same or corresponding components to the first preferred embodiment shown in **FIGS. 2A and 2B** are represented by the same reference numerals; and the same description is not repeated to avoid redundant explanation.

[**0034**] In the semiconductor apparatus according to the second preferred embodiment, shown in **FIG. 3**, outer terminals **111** are connected to a heat-radiation pattern **105**. The heat-radiation pattern **105** is covered at the bottom surface with an insulation layer **109** except for the region where the outer terminals **111** are provided. In mounting process, the outer terminals **111** are connected to a substrate (not shown) in the same manner as outer terminals **110**.

[**0035**] Heat generated in a semiconductor chip **103** is transferred through the heat-radiation pattern **105** and the outer terminals **111** to the substrate. Thus, in the second preferred embodiment, the heat radiation rate of the semi-

conductor chip **103** is greater than the first preferred embodiment, shown in **FIGS. 2A and 2B**.

[**0036**] **FIGS. 4A and 4B** show a semiconductor apparatus according to a third preferred embodiment of the present invention. In **FIGS. 4A and 4B**, the same or corresponding components to the first and second preferred embodiments, shown in **FIGS. 2A, 2B** and **3** are represented by the same reference numerals; and the same description is not repeated to avoid redundant explanation.

[**0037**] In the third preferred embodiment, shown in **FIGS. 4A and 4B**, a heat-radiation pattern **105** is provided with round openings **105***b*, through which a gas generated from an adhesive layer **107** travels outwardly. As a result, when moisture or water contained in the adhesive layer **107** is gasified by heat of the semiconductor chip **103**, the gas is radiated out of the heat-radiation pattern **105**. Thus, undesirable force is not applied between the semiconductor chip **103** and the heat-radiation pattern **105**, and therefore, those elements are prevented from being broken.

[**0038**] **FIGS. 5A and 5B** show a semiconductor apparatus according to a fourth preferred embodiment of the present invention. In **FIGS. 6A and 5B**, the same or corresponding components to the first to third preferred embodiments, shown in **FIGS. 2A, 2B, 3, 4**A and **4**B are represented by the same reference numerals; and the same description is not repeated to avoid redundant explanation.

[**0039**] In the fourth preferred embodiment, shown in **FIGS. 5A and 5B**, a heat-radiation pattern **105** includes a radiating portion **105***c* and connecting portions **105***d*. The radiating portion **105***c* is designed to be in contact with the center of a surface **103***a* of the semiconductor chip **103**. The connecting portions **105***d* extend from the radiating portion **105***c* outwardly in the same manner as leads of the wiring pattern **102**.

[**0040**] The connecting portions **105***d* are electrically connected at one ends to electrode pads of the semiconductor chip **103** via bumps **106**. Preferably, the electrodes of the semiconductor chip **103** connected to the connecting portions **105***d* are supply electrodes or ground electrodes, which do not change in voltage. If the connecting portions **105***d* are connected to supply electrodes or ground electrodes of the semiconductor chip **103**, the heat-radiation pattern **105** can be used as a common plane, so that the voltage level can be stable. And therefore, margin to outer noise can be increased.

[**0041**] **FIG. 6** shows a semiconductor apparatus according to a fifth preferred embodiment of the present invention. In **FIG. 6**, the same or corresponding components to the first to fourth preferred embodiments, shown in **FIGS. 2A, 2B, 3, 4**A, **4**B, **5**A and **5**B are represented by the same reference numerals; and the same description is not repeated to avoid redundant explanation.

[**0042**] In the fifth preferred embodiment, shown in **FIG. 6, a** heat-radiation pattern **105** includes a radiating portion **105***c* and connecting portions **105***d*. Each pair of the connecting portions **105***d* are arranged at the both sides of a micro-stream line (high-speed signal line) **102***a* in the leads **102**. Preferably, the connecting portions **105***d* are connected to supply electrodes or ground electrodes, so that the connecting portions **105***d* function as a barrier which prevents cross-influence between the adjacent two signal lines.

What is claimed is:

1. A semiconductor apparatus, comprising:

an insulation tape which is provided with a device hole therein;

a semiconductor chip which is mounted in the device hole of the insulation tape and is provided at a first surface with electrode pads;

a wiring pattern which comprises leads connected at one ends to the electrode pads of the semiconductor chip; and

a heat-radiation member which is provided on the first surface of the semiconductor chip so that heat generated in the semiconductor chip is radiated outwardly through the heat-radiation member.

2. The semiconductor apparatus, according to claim 1, wherein

the heat-radiation member comprises a square-shaped radiating portion which is in contact with the first surface of the semiconductor chip; and support portions which extend outwardly from the corners of the radiation portion, each support portion being connected to the insulation tape.

3. The semiconductor apparatus, according to claim 1, wherein

the wiring pattern and the heat-radiation member is integrally made of copper.

4. The semiconductor apparatus, according to claim 1, wherein

the semiconductor chip is arranged to expose its second surface, which is the opposite to the first surface, so that heat generated in the semiconductor chip is also radiated from the second surface.

5. The semiconductor apparatus, according to claim 1, further comprising:

an outer terminal connected at one end to the heat-radiation member and at the other end to the insulation tape, so that heat generated in the semiconductor chip is directly transferred to the insulation tape.

6. The semiconductor apparatus, according to claim 1, wherein

the heat-radiation member is in contact with the first surface of the semiconductor chip by an adhesive; and

the heat-radiation member is provided with openings so that a gas generated from the adhesive is radiated through the openings.

7. The semiconductor apparatus, according to claim 1, wherein

the heat-radiation member comprises a radiating portion which is in contact with the first surface of the semiconductor chip; and connecting portions which are connected at one ends to the electrode pad and extend outwardly.

8. The semiconductor apparatus, according to claim 7, wherein

each of the connecting portions is connected at one end to one of ground electrode and supply electrode of the semiconductor chip.

9. The semiconductor apparatus, according to claim 7, wherein

the leads comprise a micro-stream line; and

a pair of the connecting portions of the heat-radiation member are arranged at the both sides of the micro-stream line.

10. The semiconductor apparatus, according to claim 8, wherein

the leads comprise a micro-stream line; and

a pair of the connecting portions of the heat-radiation member are arranged at the both sides of the micro-stream line.

11. A frame used for fabricating a semiconductor apparatus, comprising:

an insulation tape which is provided with a device hole, in which a semiconductor chip is mounted;

a wiring pattern which comprises leads connected at one ends to electrode pads, provided on a first surface of the semiconductor chip; and

a heat-radiation member which is provided on the first surface of the semiconductor chip so that heat generated in the semiconductor chip is outwardly radiated through the heat-radiation member.

12. The frame, according to claim **11**, wherein

the heat-radiation member comprises a square-shaped radiating portion which is in contact with the first surface of the semiconductor chip; and support portions which extend outwardly from the corners of the radiation portion, each support portion being connected to the insulation tape.

13. The frame, according to claim 11, wherein

the wiring pattern and the heat-radiation member is integrally made of copper.

14. The frame, according to claim 11, wherein

the semiconductor chip is arranged to expose its second surface, which is the opposite to the first surface, so that heat generated in the semiconductor chip is also radiated from the second surface.

15. The frame, according to claim 11, further comprising:

an outer terminal connected at one end to the heat-radiation member and at the other end to the insulation tape, so that heat generated in the semiconductor chip is directly transferred to the insulation tape.

16. The frame, according to claim 11, wherein

the heat-radiation member is in contact with the first surface of the semiconductor chip by an adhesive; and

the heat-radiation member is provided with openings so that a gas generated from the adhesive is radiated through the openings.

17. The frame, according to claim 11, wherein

the heat-radiation member comprises a radiating portion which is in contact with the first surface of the semiconductor chip; and connecting portions which are connected at one ends to the electrode pad and extend outwardly.

18. The frame, according to claim 17, wherein

each of the connecting portions is connected at one end to one of ground electrode and supply electrode of the semiconductor chip.

19. The frame, according to claim 17, wherein

the leads comprise a micro-stream line; and

a pair of the connecting portions of the heat-radiation member are arranged at the both sides of the micro-stream line.

20. The frame, according to claim 18, wherein

the leads comprise a micro-stream line; and

a pair of the connecting portions of the heat-radiation member are arranged at the both sides of the micro-stream line.

* * * * *