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(54) **SEMICONDUCTOR PACKAGE AND FABRICATION METHOD THEREOF**

(71) Applicant: **SILICONWARE PRECISION INDUSTRIES CO., LTD.**, Taichung (TW)

(72) Inventors: **Fu-Tang Huang**, Taichung (TW); **Chun-Chi Ke**, Taichung (TW)

(73) Assignee: **SILICONWARE PRECISION INDUSTRIES CO., LTD.**, Taichung (TW)

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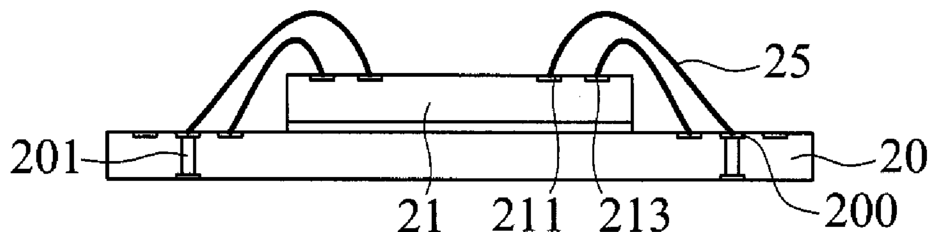
USPC **257/659**; 438/127

(57) **ABSTRACT**

A semiconductor package is provided, including: a substrate; a first semiconductor element disposed on the substrate and having a first conductive pad grounded to the substrate; a conductive layer formed on the first semiconductor element and electrically connected to the substrate; a second semiconductor element disposed on the first semiconductor element through the conductive layer; and an encapsulant formed on the substrate and encapsulating the first and second semiconductor elements. Therefore, the first and second semiconductor elements are protected from electromagnetic interference (EMI) shielding with the conductive layer being connected to the grounding pad of the substrate. A fabrication method of the semiconductor package is also provided.



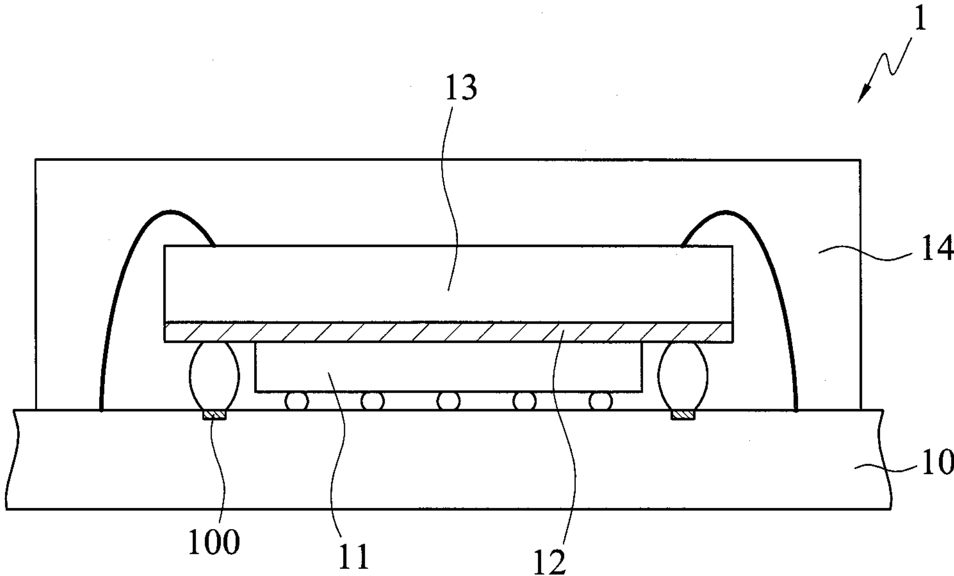


FIG. 1 (PRIOR ART)

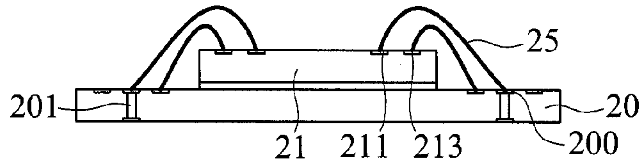


FIG. 2A

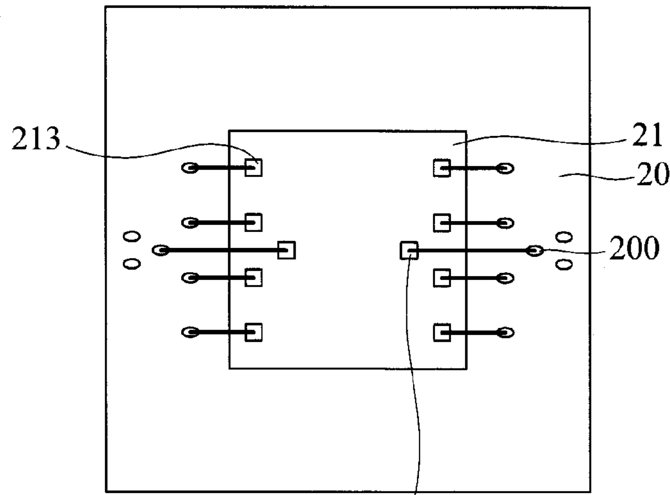


FIG. 2A'

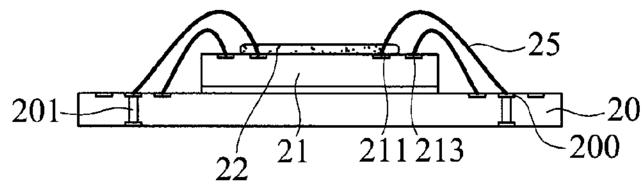


FIG. 2B

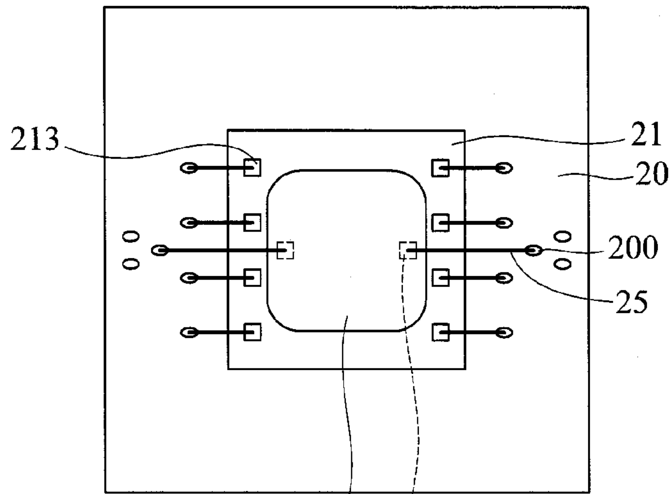


FIG. 2B'

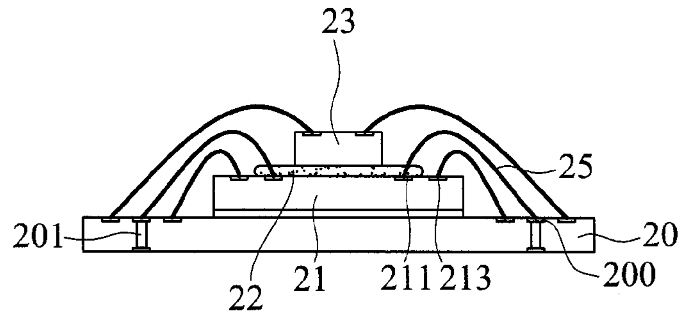


FIG. 2C

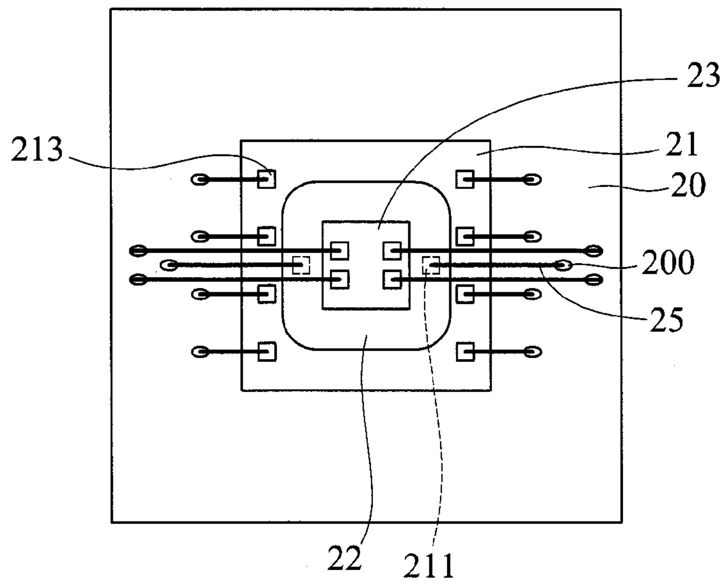


FIG. 2C'

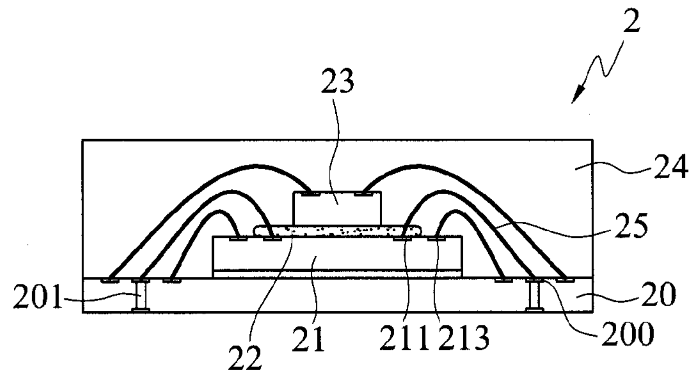


FIG. 2D

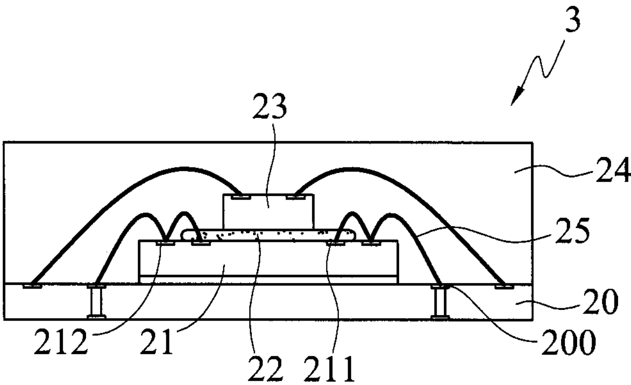


FIG. 3

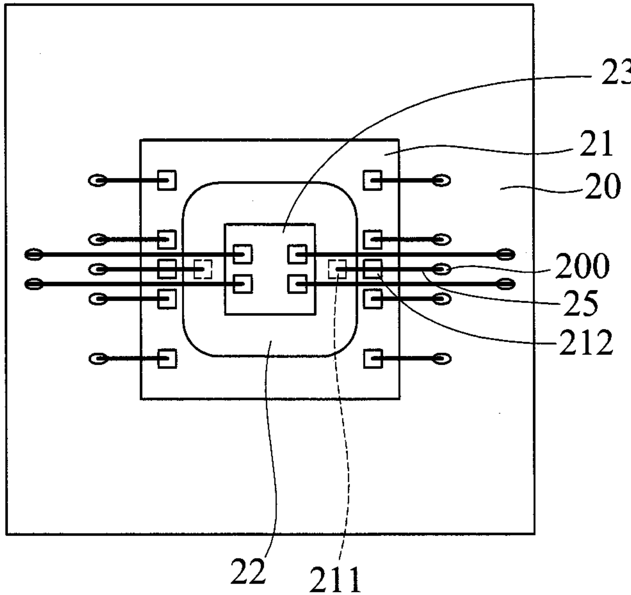


FIG. 3'

4
23
24
25
20
212 21 22 211 210 200

FIG. 4

23
21
20
200
25
212
22 211

FIG. 4'

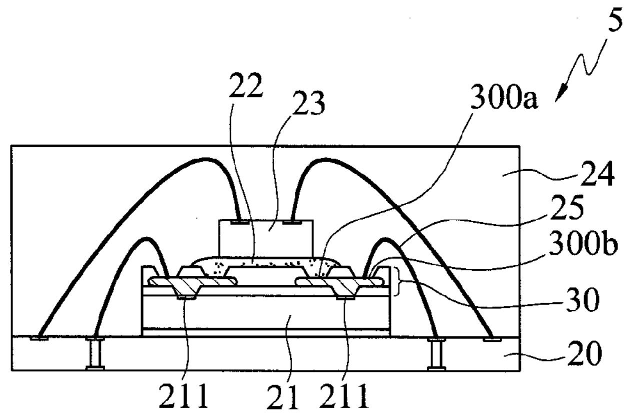


FIG. 5

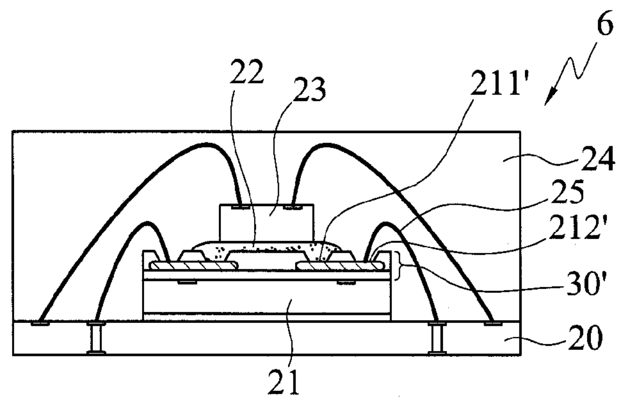


FIG. 6

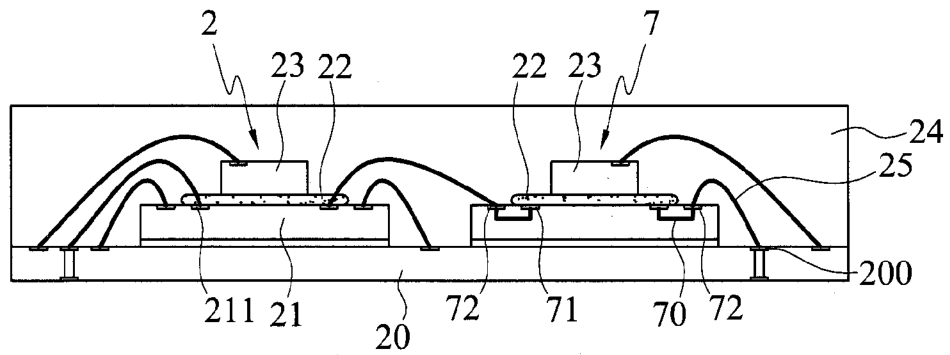


FIG. 7

SEMICONDUCTOR PACKAGE AND FABRICATION METHOD THEREOF

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] This invention relates to semiconductor packages, and, more particularly, to a semiconductor package having an EMI shielding function and a fabrication method thereof.

[0003] 2. Description of Related Art

[0004] With the development of electronic industry, electronic products at the market have demands for light weight, compact, high performance and multi functions. A semiconductor package inside a product thereby is developed toward to high computation speed, high element density and high complexity, and is further integrated with electronic components having other biological, optical, mechanical, electrical, magnetic and the like functions into the same die.

[0005] In order to correspond the trend of compact semiconductor package, system in package (SiP) develops a package structure of stacked die. However, the structure increases the element density, and results the electromagnetic interference (EMI) between a top die and a bottom die.

[0006] In order to solve the EMI problem between the top and bottom dies, the prior art forms a metal layer on the bottom face of the top die by a sputtering method. Therefore the metal layer is between the top die and the bottom die, and the EMI shielding effect can be achieved after grounding the metal layer.

[0007] Please refer to FIG. **1**, which is a schematic cross sectional view of a semiconductor package **1** according to the prior art. As shown in FIG. **1**, the semiconductor package **1** comprises: a substrate **10** having a grounding pad **100**; a first semiconductor element **11** disposed and electrically connected through a conductive bump to the substrate **10**; a second semiconductor element **13** with a sputtered metal layer **12**, wherein the second semiconductor element **13** is disposed on the first semiconductor element **11** by the side of the metal layer **12**, and the metal layer **12** is connected to the grounding pad **100** on the substrate **10**; and an encapsulant **14** formed on the substrate **10** such that the first semiconductor element **11** and the second semiconductor element **13** are encapsulated in the encapsulant **14**.

[0008] However, the metal layer **12** is formed by a sputtering method to achieve the EMI shielding effect, which is complicated and costly.

[0009] Therefore, how to overcome the EMI problem of the prior art is substantially an issue desirably to be solved in the industry.

SUMMARY OF THE INVENTION

[0010] In view of the problems of the above-mentioned prior art, the present invention provides a semiconductor package, comprising: a substrate; a first semiconductor element disposed on the substrate and having a first conductive pad grounded to the substrate; a conductive layer formed on the first semiconductor element and electrically connected to the first conductive pad; a second semiconductor element disposed on the conductive layer; and an encapsulant formed on the substrate and encapsulating the first and second semiconductor elements.

[0011] The present invention further provides a fabrication method of the semiconductor package, comprising: providing a substrate; disposing on the substrate a first semiconductor element having a first conductive pad; grounding the first conductive pad and the substrate; forming on the first semiconductor element a conductive layer electrically connected to the first conductive pad; disposing a second semiconductor element on the conductive layer; and forming on the substrate an encapsulant encapsulating the first and second semiconductor elements.

[0012] In an embodiment, the first conductive pad is grounded to the substrate by bonding wires.

[0013] In an embodiment, the first semiconductor element has a redistribution layer formed on the first conductive pad, the conductive layer is disposed on the redistribution layer, and the redistribution layer electrically connects the first conductive pad to the conductive layer and is grounded to the substrate. In an embodiment, the redistribution layer has a conductive land electrically connected to the first conductive pad, and the conductive land is grounded to the substrate by bonding wires.

[0014] In an embodiment, the first semiconductor element has a redistribution layer, and the redistribution layer has the first conductive pad.

[0015] The present invention further provides a semiconductor package, comprising: a substrate; a first semiconductor element disposed on the substrate and having a first conductive pad and a second conductive pad connected to the first conductive pad and grounded to the substrate; a conductive layer formed on the first semiconductor element and electrically connected to the first conductive pad; a second semiconductor element disposed on the conductive layer; and an encapsulant formed on the substrate and encapsulating the first and second semiconductor elements.

[0016] The present invention further provides a fabrication method of the semiconductor package, comprising: providing a substrate; disposing on the substrate a first semiconductor element having a first conductive pad and a second conductive pad connected to the first conductive pad; grounding the second conductive pad and the substrate; forming on the first semiconductor element a conductive layer electrically connected to the first conductive pad; disposing a second semiconductor element on the conductive layer; and forming on the substrate an encapsulant encapsulating the first and second semiconductor elements.

[0017] In an embodiment, the first conductive pad is electrically connected to the second conductive pad by bonding wires. In an embodiment, the first semiconductor element has an internal circuit, and the first conductive pad is electrically connected to the second conductive pad by the internal circuit.

[0018] In an embodiment, the substrate has a grounding pad for being grounded.

[0019] In an embodiment, the second semiconductor element is electrically connected to the substrate.

[0020] In an embodiment, the conductive layer is made of a conductive adhesive.

[0021] In an embodiment, an electrical element is further disposed on the substrate and grounded to the substrate and the first semiconductor element.

[0022] From the above, in the semiconductor package and fabrication methods thereof according to the present invention, the EMI shielding effect is achieved by disposing a conductive layer between a first semiconductor element and a second semiconductor to prevent EMI between semiconductor elements.

BRIEF DESCRIPTION OF DRAWINGS

[0023] The invention can be more fully understood by reading the following detailed description of the preferred embodiments, with reference made to the accompanying drawings, wherein:

[0024] FIG. **1** is a schematic sectional view illustrating a structure of a prior semiconductor package according to the prior art;

[0025] FIGS. **2**A-**2**D are schematic sectional views of a fabrication method of a semiconductor package of a first embodiment according to the present invention, wherein FIG. **2**A' is a top view of FIG. **2**A, FIG. **2**B' is a top view of FIG. **2**B, and FIG. **2**C' is a top view of FIG. **2**C;

[0026] FIGS. **3** and **3'** are a schematic sectional view and a top view of a semiconductor package of a second embodiment according to the present invention, wherein FIG. **3'** is the top view of FIG. **3**;

[0027] FIGS. **4** and **4'** are a schematic sectional view and a top view of a semiconductor package of a third embodiment according to the present invention, wherein FIG. **4'** is the top view of FIG. **4**;

[0028] FIG. **5** is a schematic sectional view of a semiconductor package of a fourth embodiment according to the present invention;

[0029] FIG. **6** is a schematic sectional view of a semiconductor package of a fifth embodiment according to the present invention; and

[0030] FIG. **7** is a schematic sectional view of a semiconductor package of a sixth embodiment according to the present invention;

DETAILED DESCRIPTION OF THE INVENTION

[0031] The following illustrative embodiments are provided to illustrate the disclosure of the present invention, these and other advantages and effects can be apparently understood by those in the art after reading the disclosure of this specification. The present invention can also be performed or applied by other different embodiments. The details of the specification may be on the basis of different points and applications, and numerous modifications and variations can be devised without departing from the spirit of the present invention.

[0032] It should be advised that the structure, ratio, and size as illustrated in this context are only used for disclosures of this specification, provided for persons skilled in the art to understand and read, and technically do not have substantial meaning. Any modification of the structure, change of the ratio relation, or adjustment of the size should be involved in the scope of disclosures in this specification without influencing the producible efficacy and the achievable objective of this specification. Also, the referred terms such as “on”, “first”, “second” and “one” in this specification are only for the convenience to describe, not for limiting the scope of embodiment in this invention. Those changes or adjustments of relative relationship without substantial change of technical content should also be considered within the category of implementation.

[0033] FIGS. **2**A-**2**D are schematic sectional views illustrating a fabrication method of a semiconductor package of a first embodiment according to the present invention, wherein FIG. **2**A' is a top view of FIG. **2**A, FIG. **2**B' is a top view of FIG. **2**B, and FIG. **2**C' is a top view of FIG. **2**C.

[0034] As shown in FIGS. **2**A and **2**A', a substrate **20** having a plurality of grounding pads **200** and grounding vias **201** is provided, a first semiconductor element **21** is disposed on the substrate **20**, the first semiconductor element **21** has a plurality of first conductive pads **211** for being grounded the substrate **20**.

[0035] In an embodiment, the first conductive pad **211** is electrically connected to the grounding pad **200** by bonding wires **25**, and the first semiconductor element **21** is a die or a packaged element.

[0036] As shown in FIG. **2**B, a conductive layer **22** is formed on the first semiconductor element **21**, and the conductive layer **22** covers the first conductive pads **211**, and coats one end of each of the bonding wires **25** connected to the first conductive pads to electrically connects each of the first conductive pads **211**.

[0037] In an embodiment, the first semiconductor element **21** also has other connecting pads **213**, and the conductive layer **22** does not cover the connecting pads **213**, as shown in FIG. **2**B'.

[0038] Moreover, the conductive layer **22** is made of a conductive adhesive containing a metal material that can shield and block EMI to achieve the EMI shielding effect.

[0039] As shown in FIG. **2**C, a second semiconductor element **23** is disposed on the conductive layer **22**, and stacked on the first semiconductor element **21**. The second semiconductor element **23** is electrically connected to the substrate **20** by bonding wires **25**.

[0040] In an embodiment, the second semiconductor element **23** is a die or a packaged element.

[0041] As shown in FIG. **2**D, an encapsulant **24** is formed on the substrate **20** to encapsulate the first semiconductor element **21** and the second semiconductor element **23** to fabricate a semiconductor package **2** according to the present invention.

[0042] In an embodiment, forming methods and materials of the encapsulant **24** is adaptable for persons skilled in the art, and thus will not described herein.

[0043] In a second embodiment shown in FIGS. **3** and **3'**, the first semiconductor element **21** further has a second conductive pad **212** electrically connected to the first conductive pad **211**, and the second conductive pad **212** is electrically connected to the substrate **20** by bonding wires **25**, wherein the first conductive pad **211** is electrically connected to the second conductive pad **212** by bonding wires **25**.

[0044] In a third embodiment shown in FIGS. **4** and **4'**, the first semiconductor element **21** further has an internal circuit **210** to electrically connect the first conductive pad **211** to the second conductive pad **212**.

[0045] In a fourth embodiment shown in FIG. **5**, the first semiconductor element **21** has a redistribution layer **30** on the first conductive pad **211**, the conductive layer **22** is disposed and electrically connected to the redistribution layer **30**, and the redistribution layer **30** has conductive lands **300*a***, **300*b*** electrically connected to the first conductive pad **211**. A portion of the electrical contact **300*b*** is grounded to the substrate by bonding wires **25**.

[0046] In a fifth embodiment shown in FIG. **6**, the interconnected first conductive pad **211'** and second conductive pad **212'** may be formed in the redistribution layer **30'**.

[0047] The present invention utilizes the design of conductive layer **22** to effectively conduct remaining electricity out to the substrate **20** for grounding such that to overcome the EMI problem between the first semiconductor element **21** and

the second semiconductor element **23**. The semiconductor package **2**, **3**, **4**, **5**, **6** according to the present invention thereby have better EMI shielding effect.

[0048] As shown in FIG. **7**, an electronic element **7** is additionally disposed on the substrate **20** of the semiconductor package **2**, and is grounded to the substrate **20** and the first conductive pad **211**.

[0049] In an embodiment, the electronic element **7** is considered as a stacked die structure of a semiconductor package **4** shown in FIG. **4**. The second conductive pad **72** of the electronic element **7** is for being grounded the substrate **20** and electrically connected to the first conductive pad **211** of the semiconductor package **2**, and the first conductive pad **71** of the electronic element **7** is electrically connected to the second conductive pad **72** of the electronic element **7** by an internal circuit **70**.

[0050] The present invention provides a semiconductor package **2**, **3**, **4**, **5**, **6**, comprising: a substrate **20**, a first semiconductor element **21** disposed on the substrate **20**, a conductive layer **22** formed on the first semiconductor element **21**, a second semiconductor element **23** disposed on the conductive layer **22**, and an encapsulant **24** formed on the substrate **20**.

[0051] The substrate **20** has a plurality of grounding pads **200**.

[0052] The first semiconductor element **21** has a plurality of first conductive pads **211** grounded to the grounding pads **200** by bonding wires **25**.

[0053] In an embodiment, the first semiconductor element **21** further has a second conductive pad **212** electrically connected to the first conductive pad **211** by bonding wires **25** or an internal circuit, and the second conductive pad **212** is electrically connected to the substrate **20** by bonding wires **25**.

[0054] The conductive layer **22** is electrically connected to the first conductive pad **211**.

[0055] In an embodiment, the conductive layer **22** is made of a conductive adhesive.

[0056] The second semiconductor element **22** is electrically connected to the substrate **20**.

[0057] The encapsulant **24** encapsulates the first and second semiconductor elements **21**, **22**.

[0058] In an embodiment, the first semiconductor element **21** has a redistribution layer **30** on the first conductive pad **211**, and the conductive **22** is disposed on the redistribution layer **30** to electrically connect the first conductive pad **211** to the conductive layer and ground to the substrate **20**. In an embodiment, the redistribution layer **30** further has conductive lands **300*a***, **300*b*** electrically connected to the first conductive pad **211**, and the conductive land **300*b*** is grounded to the substrate **20** by bonding wires **25**.

[0059] In an embodiment, a redistribution layer **30'** has the conductive pad **211'**.

[0060] In summary, the semiconductor package and fabrication methods thereof according to the present invention overcome the drawback of generating EMI while using a stacked die structure in the prior semiconductor package by a design of conductive layer. Advantages such as simple process, low cost and various applications are provided.

[0061] The foregoing descriptions of the detailed embodiments are only illustrated to disclose the features and functions of the present invention and not restrictive of the scope of the present invention. It should be understood to those in the art that all modifications and variations according to the spirit and principle in the disclosure of the present invention should fall within the scope of the appended claims.

What is claimed is:

1. A semiconductor package, comprising:

a substrate;

a first semiconductor element disposed on the substrate and having a first conductive pad grounded to the substrate;

a conductive layer formed on the first semiconductor element and electrically connected to the first conductive pad;

a second semiconductor element disposed on the conductive layer; and

an encapsulant formed on the substrate and encapsulating the first and second semiconductor elements.

2. The semiconductor package of claim **1**, wherein the substrate has a grounding pad for being grounded.

3. The semiconductor package of claim **1**, wherein the first conductive pad is grounded to the substrate by bonding wires.

4. The semiconductor package of claim **1**, wherein the second semiconductor element is electrically connected to the substrate.

5. The semiconductor package of claim **1**, wherein the first semiconductor element has a redistribution layer formed on the first conductive pad, the conductive layer is disposed on the redistribution layer, and the redistribution layer electrically connects the first conductive pad to the conductive layer and is grounded to the substrate.

6. The semiconductor package of claim **5**, wherein the redistribution layer has a conductive land electrically connected to the first conductive pad, and the conductive land is grounded to the substrate by bonding wires.

7. The semiconductor package of claim **1**, wherein the first semiconductor element has a redistribution layer, and the redistribution layer has the first conductive pad.

8. The semiconductor package of claim **1**, wherein the conductive layer is made of a conductive adhesive.

9. The semiconductor package of claim **1** further comprising an electronic element disposed on the substrate and grounded to the substrate and the first semiconductor element.

10. A semiconductor package, comprising:

a substrate;

a first semiconductor element disposed on the substrate and having a first conductive pad and a second conductive pad connected to the first conductive pad and grounded to the substrate;

a conductive layer formed on the first semiconductor element and electrically connected to the first conductive pad;

a second semiconductor element disposed on the conductive layer; and

an encapsulant formed on the substrate and encapsulating the first and second semiconductor elements.

11. The semiconductor package of claim **10**, wherein the substrate has a grounding pad for being grounded.

12. The semiconductor package of claim **10**, wherein the second conductive pad is grounded to the substrate by bonding wires.

13. The semiconductor package of claim **10**, wherein the first conductive pad is electrically connected to the second conductive pad by bonding wires.

14. The semiconductor package of claim **10**, wherein the first semiconductor element has an internal circuit, and the

first conductive pad is electrically connected to the second conductive pad through the internal circuit.

15. The semiconductor package of claim **10**, wherein the second semiconductor element is electrically connected to the substrate.

16. The semiconductor package of claim **10**, wherein the first semiconductor element has a redistribution layer, and the redistribution layer has the first and second conductive pads.

17. The semiconductor package of claim **10**, wherein the conductive layer is made of a conductive adhesive.

18. The semiconductor package of claim **10** further comprising an electronic element disposed on the substrate and grounded to the substrate and the first semiconductor element.

19. A fabrication method of a semiconductor package, comprising:

providing a substrate;

disposing on the substrate a first semiconductor element having a first conductive pad;

grounding the first conductive pad and the substrate;

forming on the first semiconductor element a conductive layer electrically connected to the first conductive pad;

disposing a second semiconductor element on the conductive layer; and

forming on the substrate an encapsulant encapsulating the first and second semiconductor elements.

20. The fabrication method of claim **19**, wherein the substrate has a grounding pad for being grounded.

21. The fabrication method of claim **19**, wherein the first conductive pad is grounded to the substrate by bonding wires.

22. The fabrication method of claim **19**, wherein the second semiconductor element is electrically connected to the substrate.

23. The fabrication method of claim **19**, wherein the first semiconductor element has a redistribution layer formed on the first conductive pad, the conductive layer is disposed on the redistribution layer, and the redistribution layer electrically connects the first conductive pad to the conductive layer and is grounded to the substrate.

24. The fabrication method of claim **23**, wherein the redistribution layer has a conductive land electrically connected to the first conductive pad, and the conductive land is grounded to the substrate by bonding wires.

25. The fabrication method of claim **19**, wherein the first semiconductor element has a redistribution layer, and the redistribution layer has the first conductive pad.

26. The fabrication method of claim **19**, wherein the conductive layer is made of a conductive adhesive.

27. The fabrication method of claim **19** further comprising disposing on the substrate an electronic element grounded to the substrate and the first semiconductor element.

28. A fabrication method of a semiconductor package, comprising:

providing a substrate;

disposing on the substrate a first semiconductor element having a first conductive pad and a second conductive pad connected to the first conductive pad;

grounding the second conductive pad and the substrate;

forming on the first semiconductor element a conductive layer electrically connected to the first conductive pad;

disposing a second semiconductor element on the conductive layer; and

forming on the substrate an encapsulant encapsulating the first and second semiconductor elements.

29. The fabrication method of claim **28**, wherein the substrate has a grounding pad for being grounded.

30. The fabrication method of claim **28**, wherein the second conductive pad is grounded to the substrate by bonding wires.

31. The fabrication method of claim **28**, wherein the first conductive pad is electrically connected to the second conductive pad by bonding wires.

32. The fabrication method of claim **28**, wherein the first semiconductor element has an internal circuit, and the first conductive pad is electrically connected to the second conductive pad through the internal circuit.

33. The fabrication method of claim **28**, wherein the second semiconductor element is electrically connected to the substrate.

34. The fabrication method of claim **28**, wherein the first semiconductor element has a redistribution layer, and the redistribution layer has the first and second conductive pads.

35. The fabrication method of claim **28**, wherein the conductive layer is made of a conductive adhesive.

36. The fabrication method of claim **28** further comprising disposing on the substrate an electronic element grounded to the substrate and the first semiconductor element.

* * * * *