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(54) **ELECTRONIC PACKAGED DEVICE AND MANUFACTURING METHOD THEREOF**

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(51) **Int. Cl.**

H05K 5/00	(2006.01)
H05K 13/04	(2006.01)
H05K 9/00	(2006.01)

(52) **U.S. Cl.**

CPC ***H05K 13/046*** (2013.01); ***H05K 9/0037*** (2013.01); ***H05K 9/0039*** (2013.01)

(58) **Field of Classification Search**

CPC H05K 1/0218; G01R 1/01374

USPC 361/783–791

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,756,673	B2 *	6/2004	Ahn	H01L 23/66 257/751
7,349,223	B2 *	3/2008	Haemer	G01R 1/07314 29/593
2004/0112617	A1 *	6/2004	Cotton	H05K 1/0218 174/366
2005/0224946	A1 *	10/2005	Dutta	G02B 6/12002 257/686

* cited by examiner

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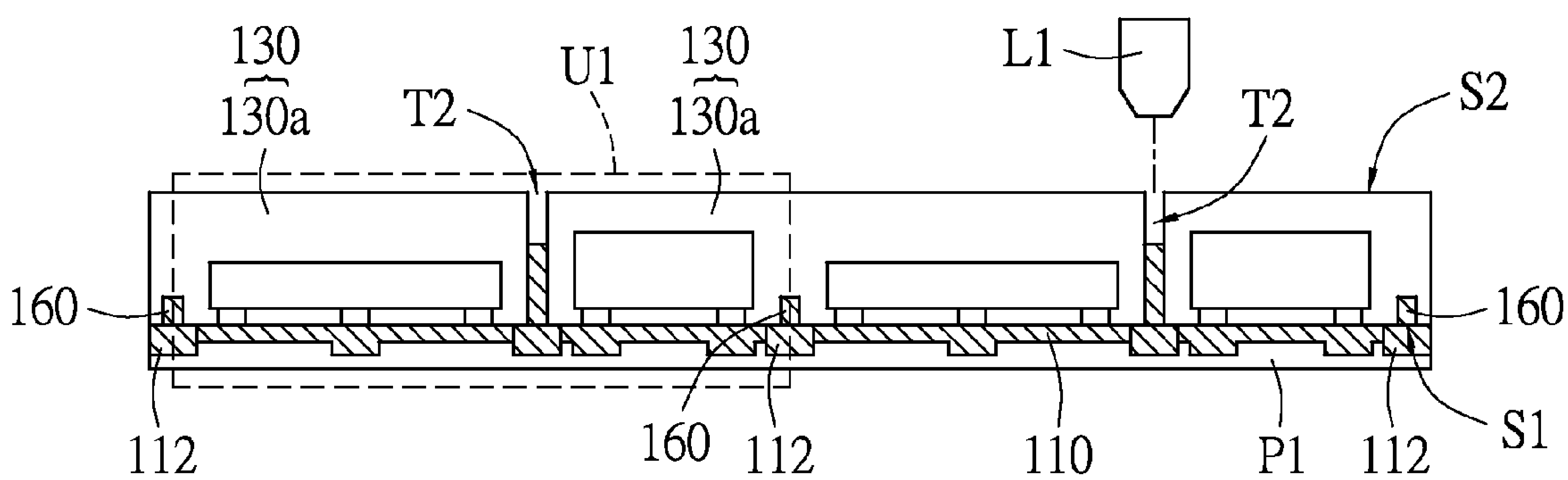
(57) **ABSTRACT**

A manufacturing method of electronic packaged device includes the following. A plurality of electronic components is disposed on a substrate carrier. An encapsulating member is disposed on the substrate carrier and covers the electronic components. The substrate carrier is separated from the encapsulating member. A plurality of first trenches is arranged on a first surface of the encapsulating member. Conductive material is disposed onto the first surface and into the first trenches to form a conductive layer. The conductive layer is patterned on the first surface to form a circuit layer. The circuit layer includes at least one grounding pad. A plurality of second trenches is arranged on a second surface of the encapsulating member. At least one shielding structure is formed in the first trenches and the second trenches. An electromagnetic shielding layer is connected to the grounding pad.

15 Claims, 7 Drawing Sheets



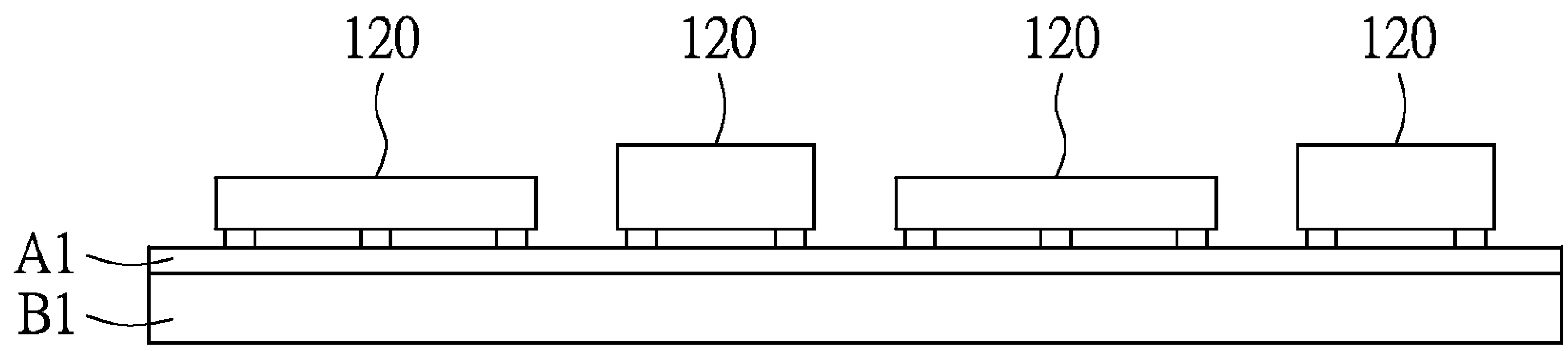


FIG.1A

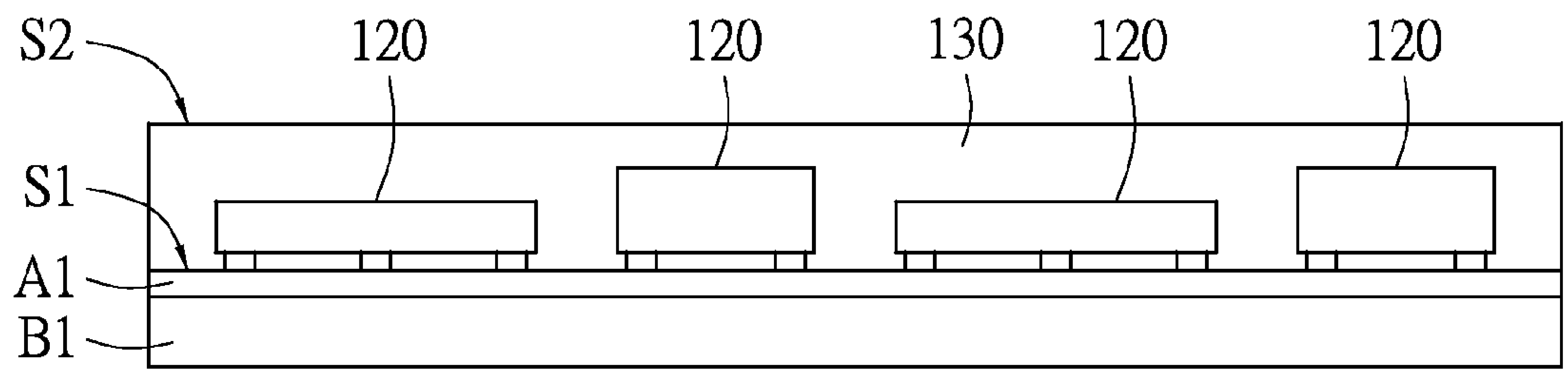


FIG.1B

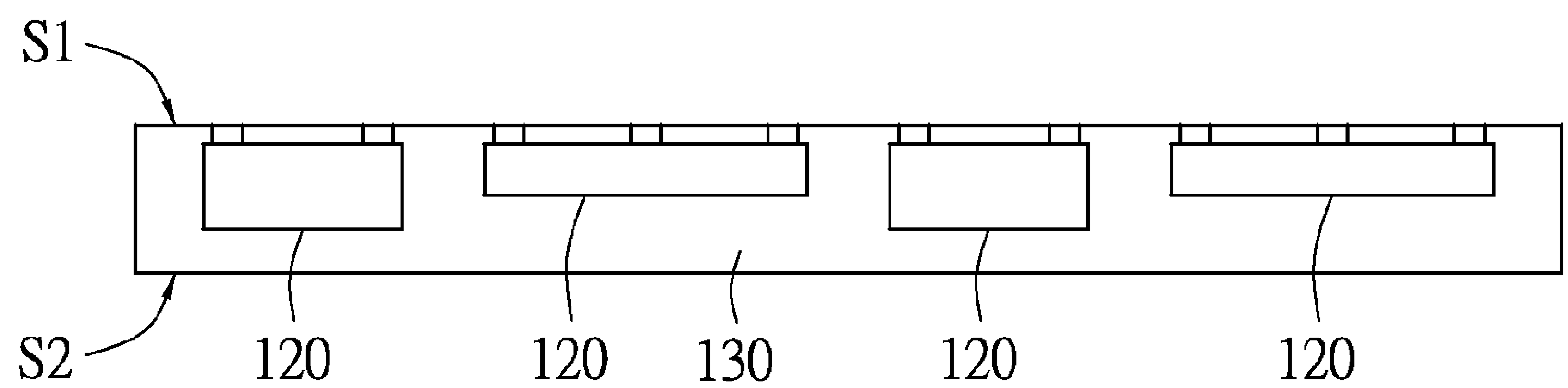


FIG.1C

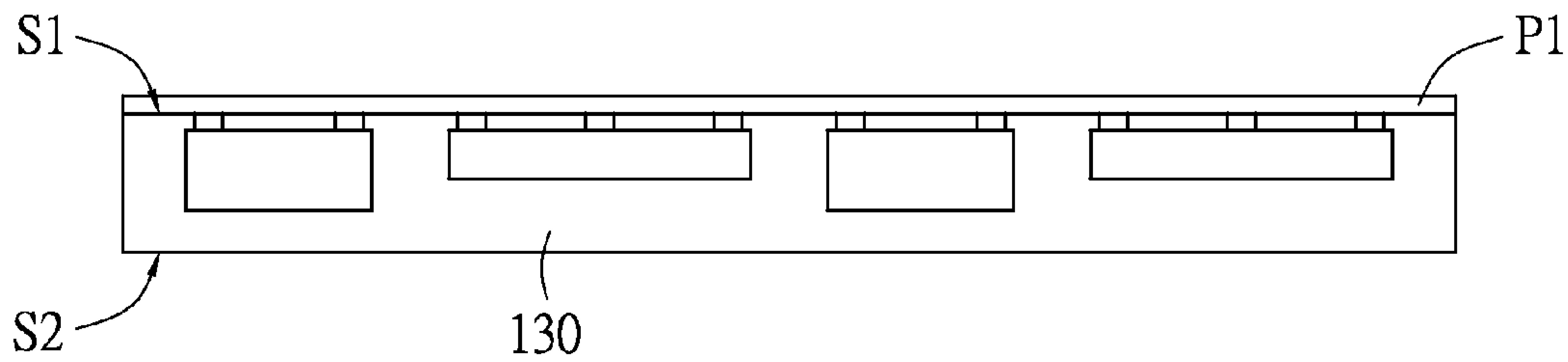


FIG.1D

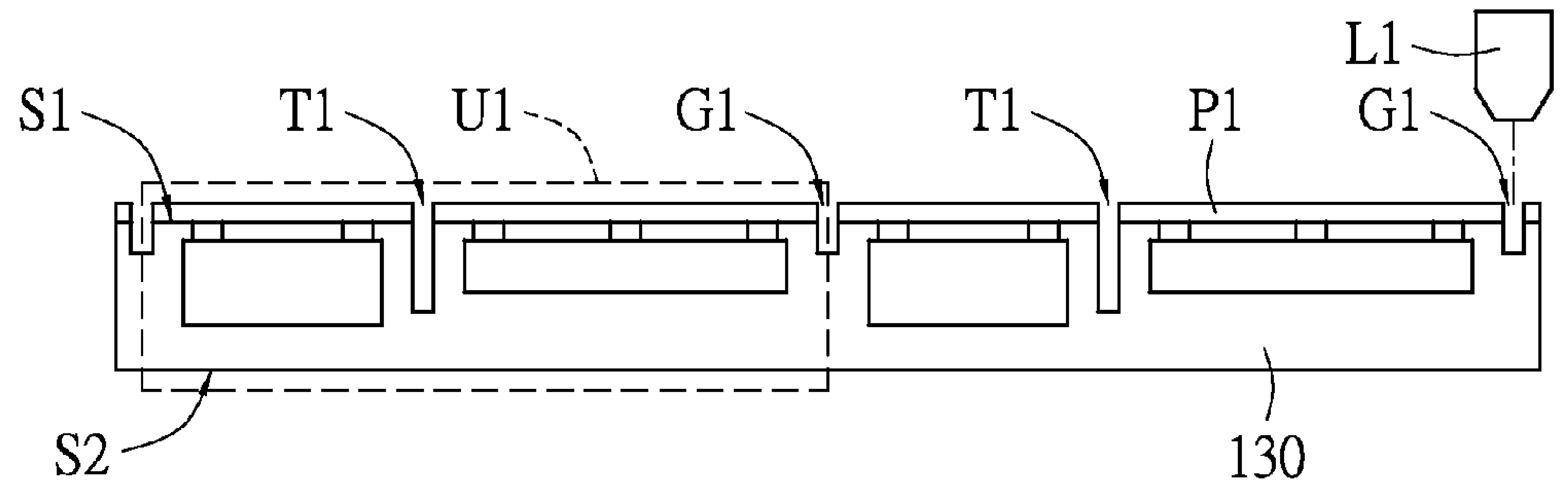


FIG.1E

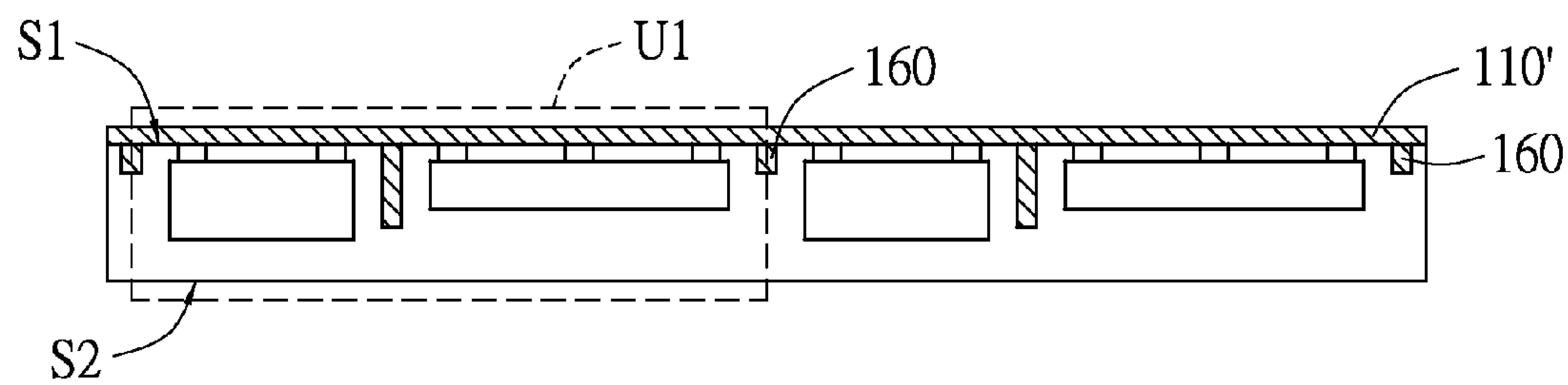


FIG.1F

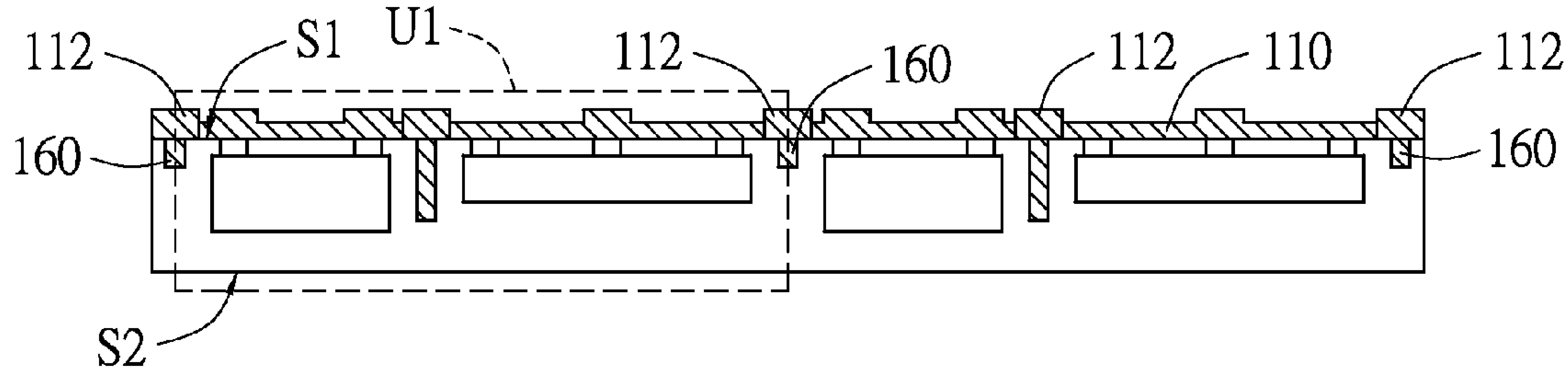


FIG.1G

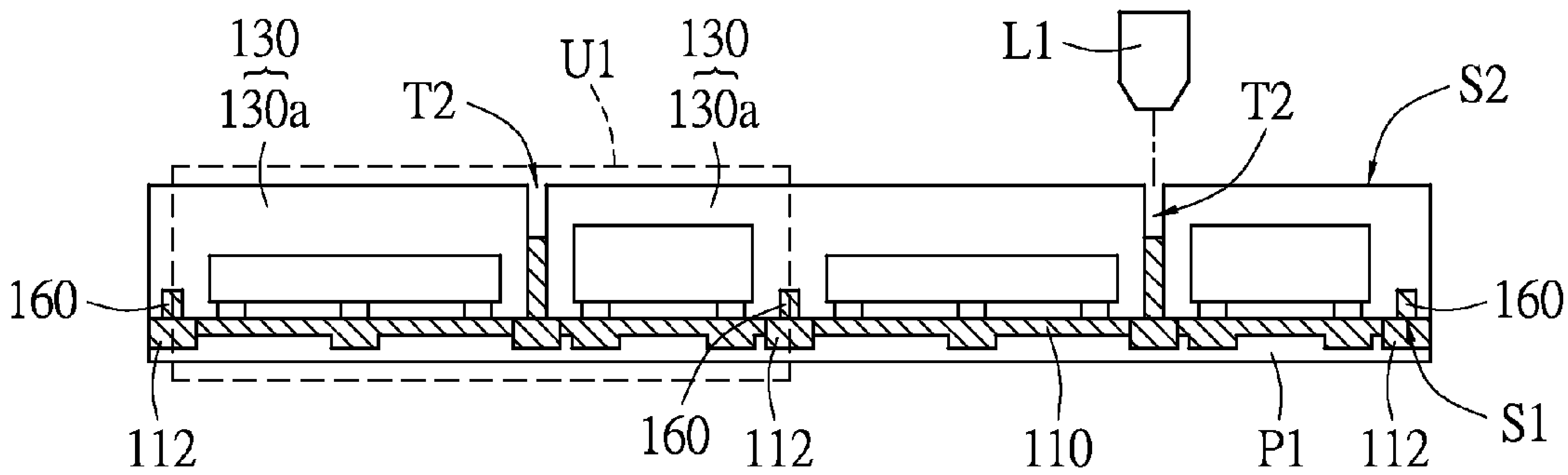

130
130a
T2
U1
130
130a
L1
T2
S2
160
160
112
160
112
110
P1
112
S1

FIG.1H

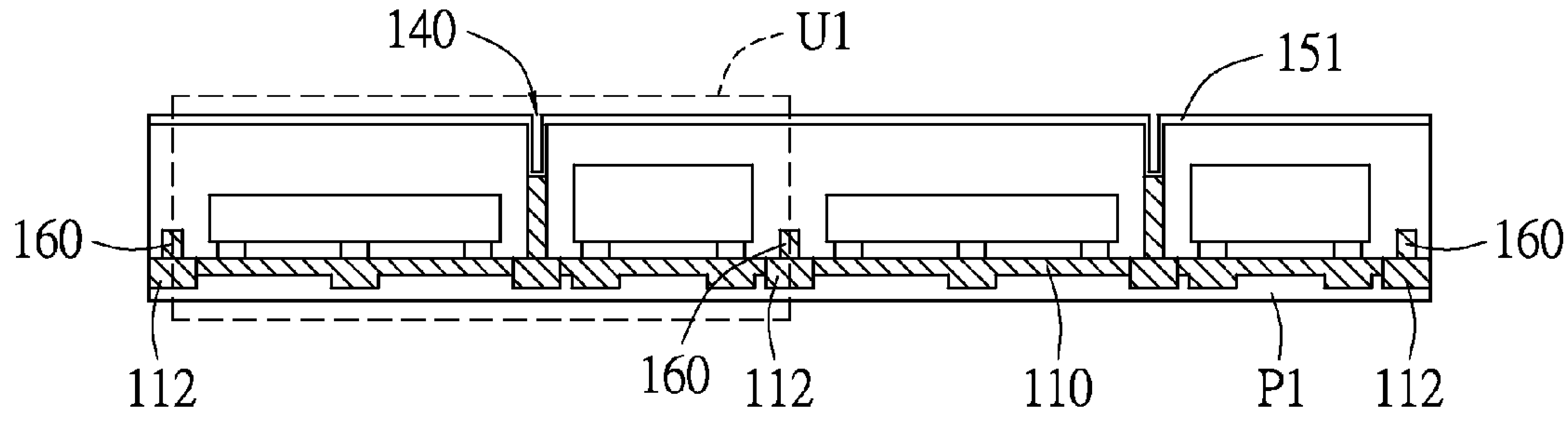
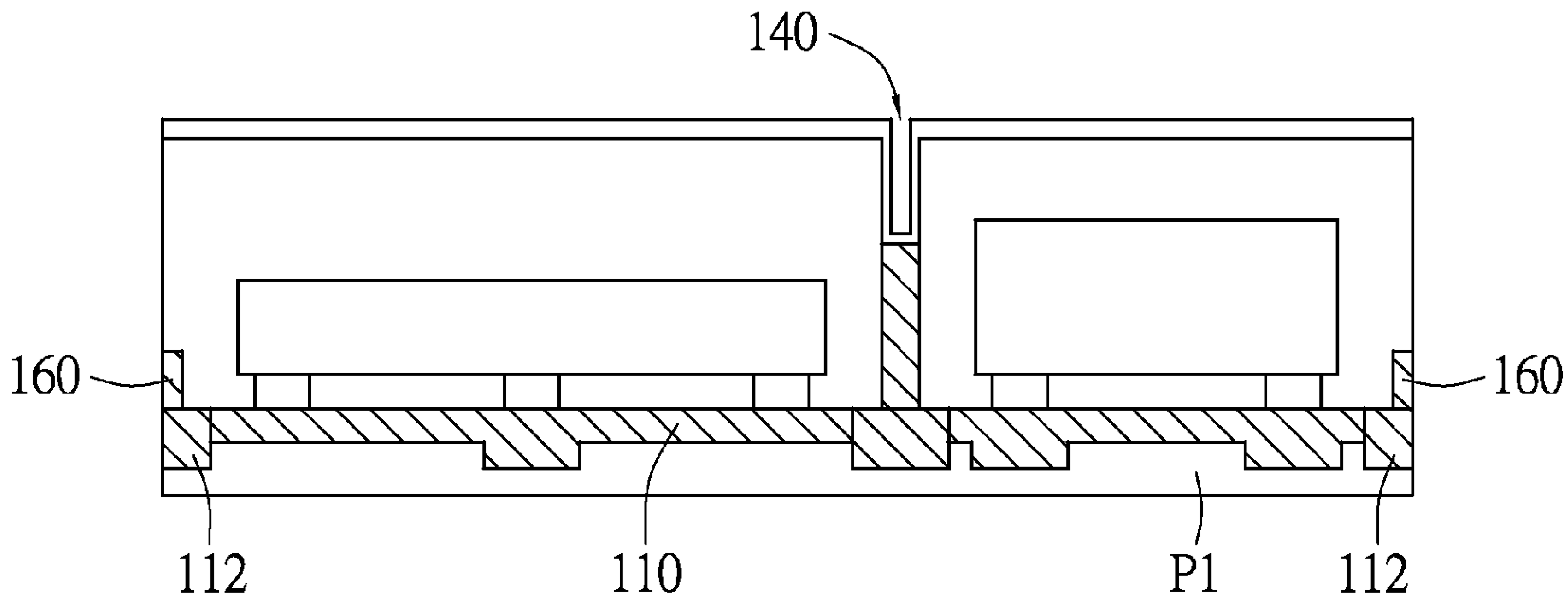
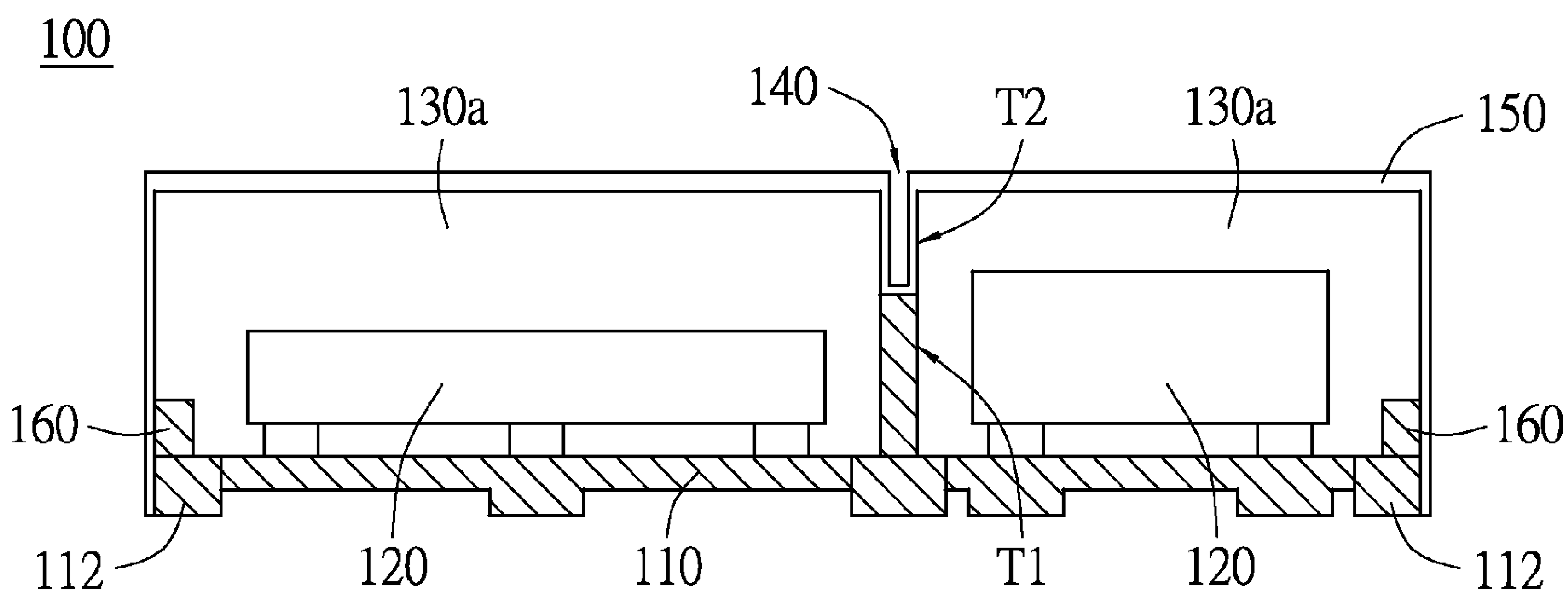

140
U1
151
160
160
112
160
112
110
P1
112

FIG.1I



140
160
160
112
110
P1
112

FIG.1J



100
130a
140
T2
130a
150
160
160
112
120
110
T1
120
112

FIG.1K

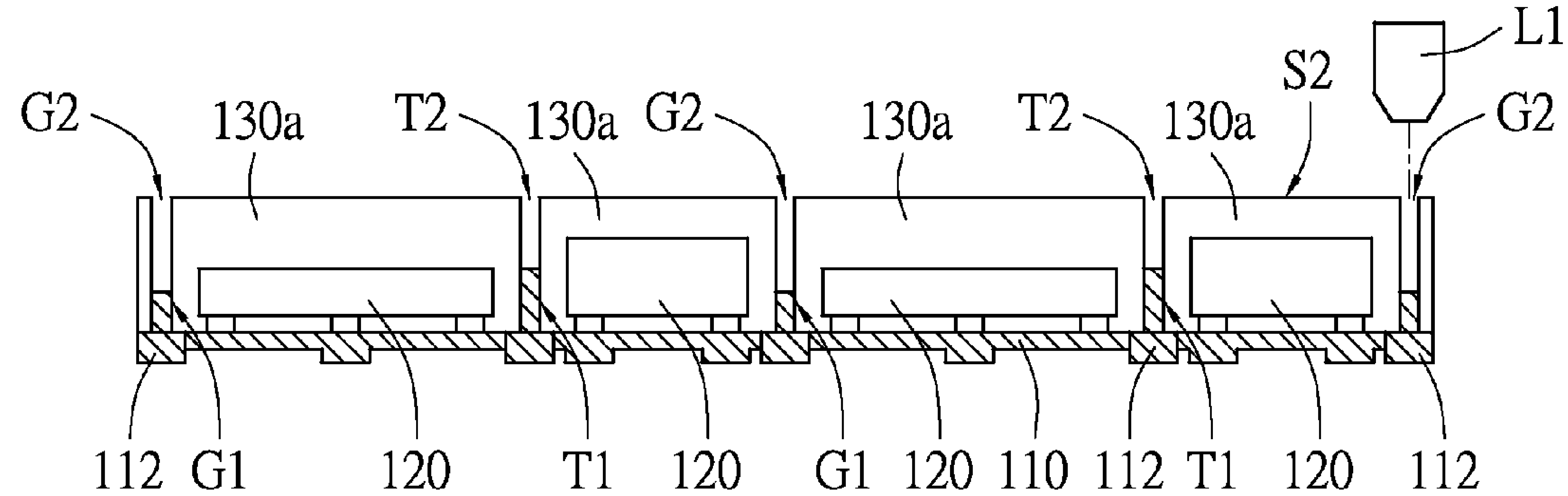


FIG.2A

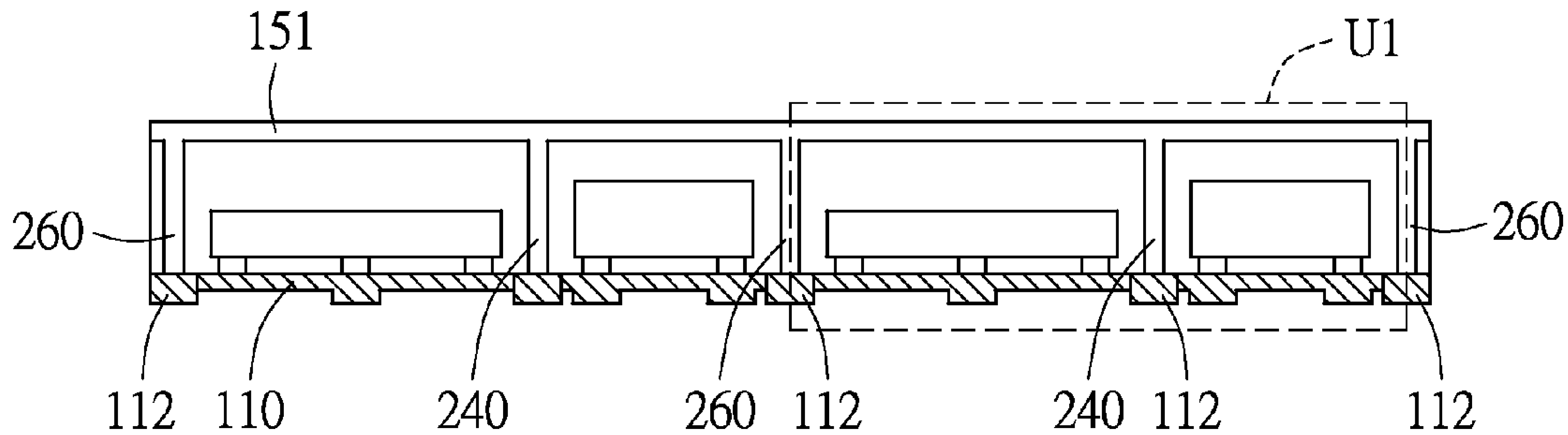


FIG.2B

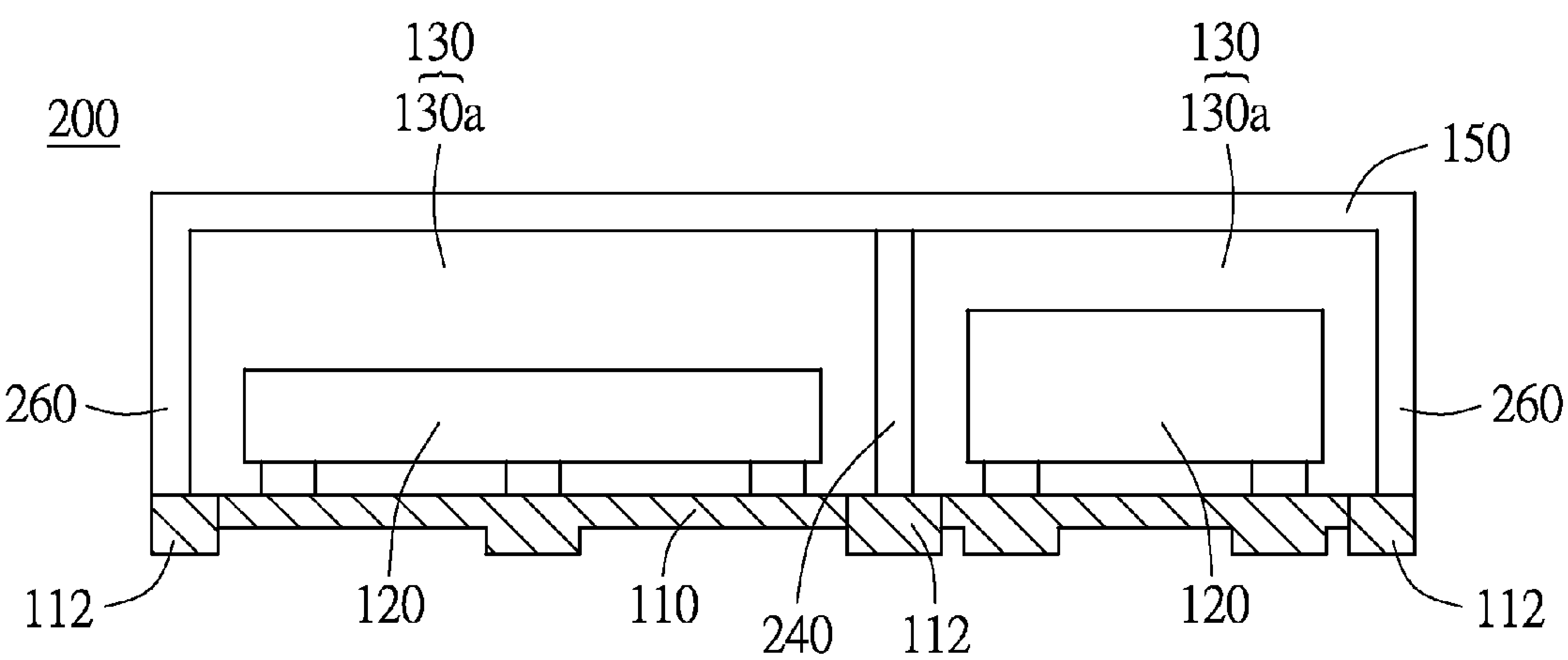


FIG.2C

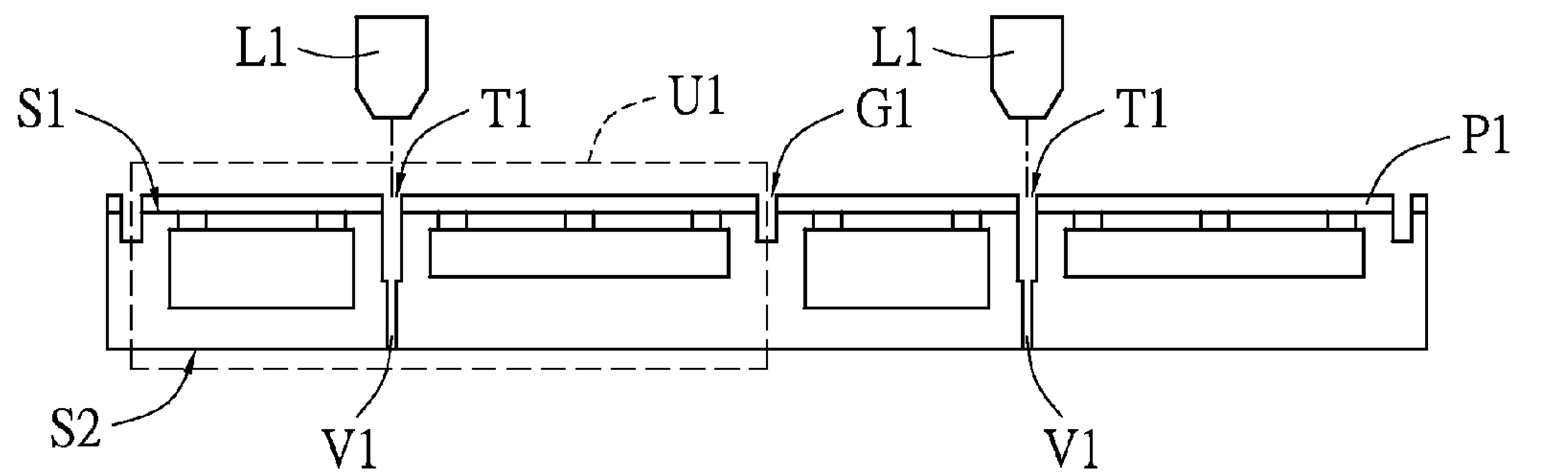


FIG.3A

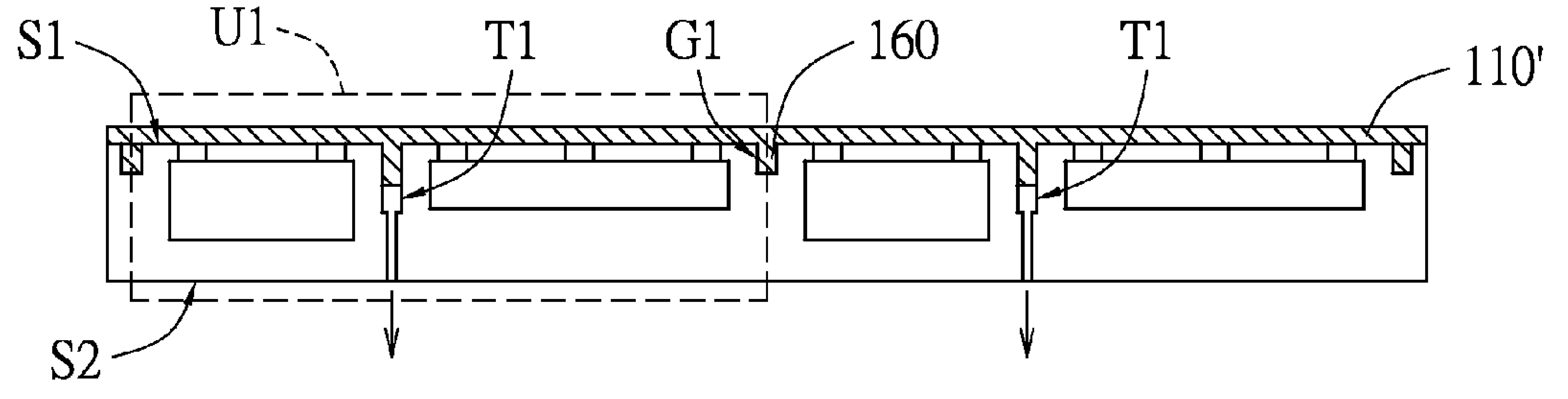


FIG.3B

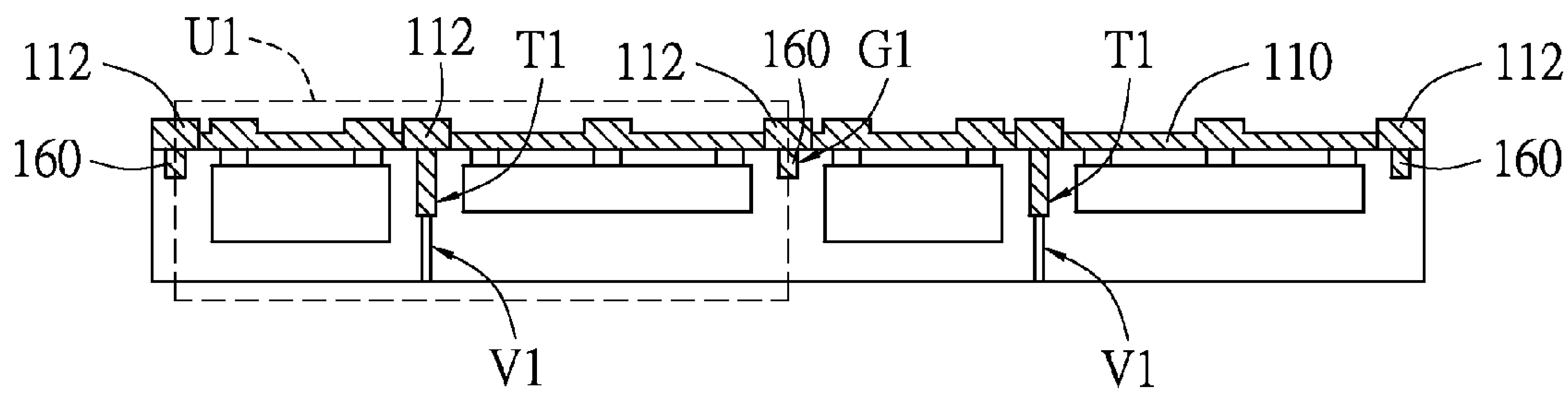


FIG.3C

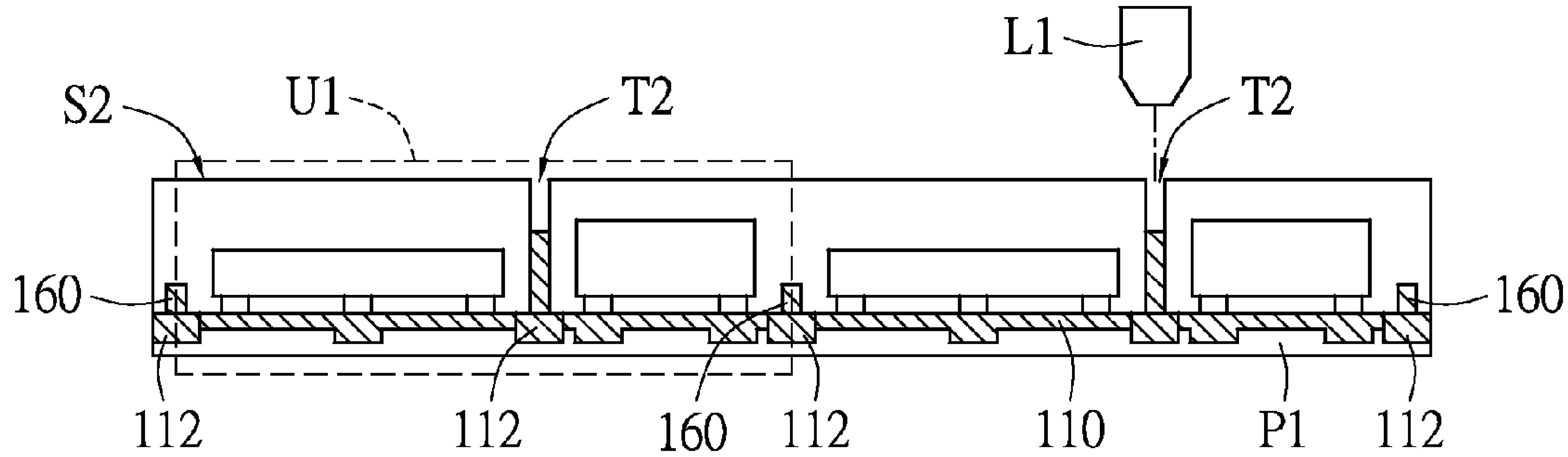


FIG.3D

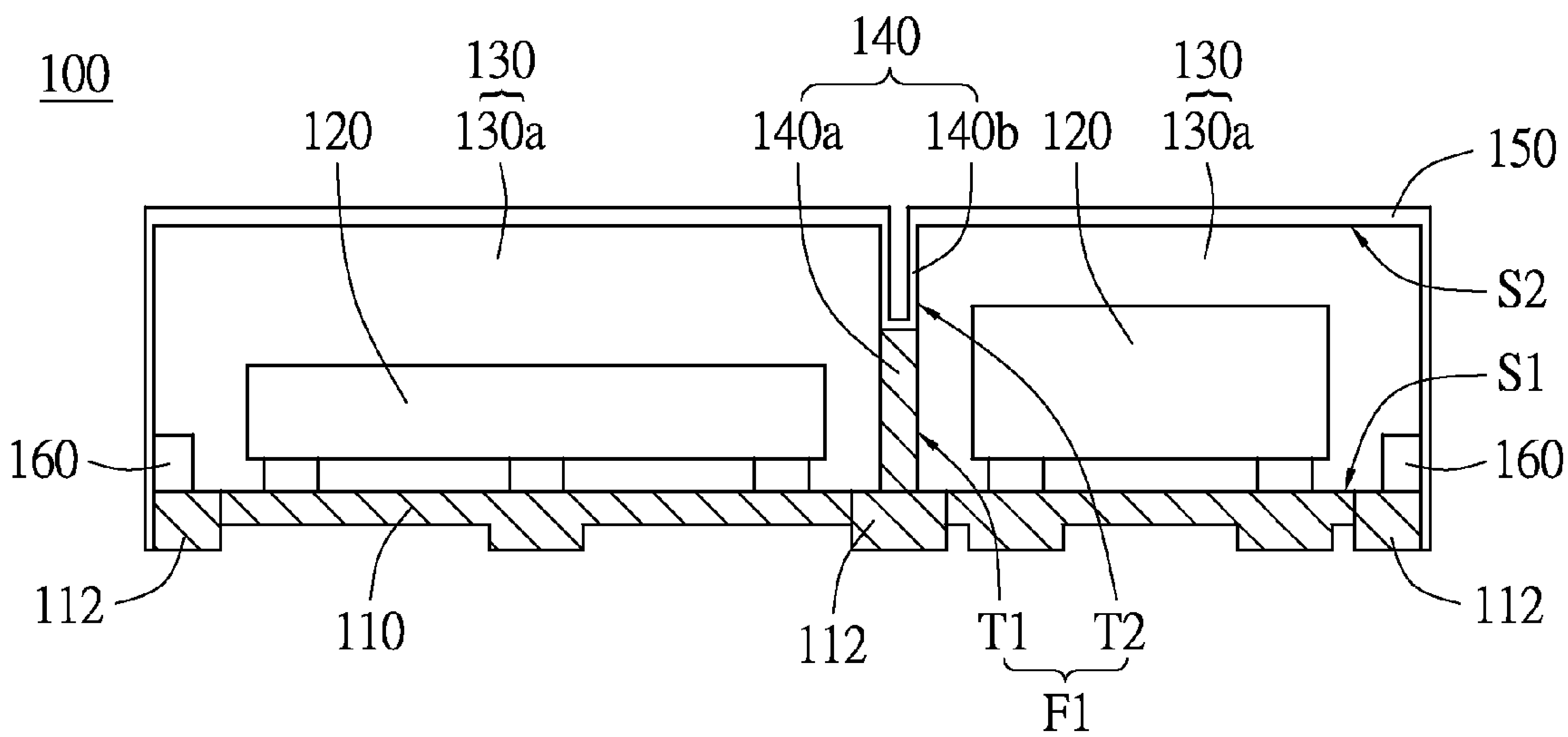

100
130
130a
120
140
140a
140b
120
130
130a
150
S2
S1
160
160
112
110
112
T1
T2
F1
112

FIG.4

ELECTRONIC PACKAGED DEVICE AND MANUFACTURING METHOD THEREOF

BACKGROUND OF THE INVENTION

1. Field of the Invention

The instant disclosure relates to an electronic packaged device and the manufacturing method thereof.

2. Description of Related Art

Most electronic packaging devices use a variety of packaging materials to package electronic components. Since electronic products have more and more functions, thus the electronic components in the electronic packaging devices corresponding increases as well. Accordingly, electromagnetic interferences between different electronic components occur more often than ever.

Typically, in order to reduce various electromagnetic interference and radio frequency interferences generated by electronic components, an electromagnetic interference (EMI) layer is designed in the electronic packaging to isolate different electronic components. Alternatively, an external metal cover (Metal lid) is installed on the electronic packaging.

However, in the climate of miniaturization, the overall packaging density of electronic packaging dramatically increases. As a result, designing electromagnetic shielding layer in electronic packaging is becoming relatively more difficult. Alternatively, a metal cover installed on the electronic packaging increases the overall package volume.

To address the above issues, the inventor strives via associated experience and research to present the instant disclosure, which can effectively improve the limitation described above.

SUMMARY OF THE INVENTION

An embodiment of the instant disclosure provide an electronic packaging device which includes a shielding structure for prevent electromagnetic interferences between electronic components.

The electronic packaged device includes a circuit layer, a plurality of electronic components, an encapsulating member, a shielding structure, at least one grounding structure, and an electromagnetic shielding layer. The circuit layer includes at least one grounding pad. The electronic components and the circuit layer are electrically connected. The encapsulating member covers at least one electronic component. A trench is formed on the encapsulating member to partition into at least two encapsulating compartments. The shielding structure is interposed between different encapsulating compartments, and the shielding structure is electrically connected to the grounding pad. The electromagnetic shielding layer is formed on the external surface of encapsulating member and electrically connected to the grounding pad.

An embodiment of the instant disclosure provides an electronic package device manufacturing method including disposing a plurality of electronic components on a surface of a substrate carrier. Disposing an encapsulating member on the surface of the substrate carrier to cover the electronic components. Separating the substrate carrier from the encapsulating member. Forming a plurality of first trenches and a plurality of first grounding trenches on a first surface of the encapsulating member. Disposing conductive material on the first surface of the encapsulating member, in the first trenches and in the first grounding trenches to form a conductive layer and a plurality of grounding structures. Patterning the conductive layer on the first surface of the encapsulating member to form a circuit layer. The circuit layer including at least one grounding pad, which electrically connected to the grounding structures. Forming a plurality of second trenches on a second surface of the encapsulating member corresponding to the first trenches, the second surface being opposite the first surface of the encapsulating member. Forming conductive material in the second trenches, and electrically connecting to the conductive material in the first trenches to cooperatively form at least one shielding structure in the first and the second trenches. Separating the encapsulating member into a plurality of packaged units by cutting through the grounding structures from the second surface of the encapsulating member. Forming an electromagnetic shielding layer on external surfaces of the packaged units with conductive material. The electromagnetic shielding layer is electrically connected to the grounding pads.

Another embodiment of the instant disclosure provides a manufacturing method of electronic package device, including configuring a plurality of electronic components on a surface of a substrate carrier. Disposing an encapsulating member on the surface of the substrate carrier to cover the electronic components. Separating the substrate carrier from the encapsulating member. Forming a plurality of first trenches and a plurality of first grounding trenches on a first surface of the encapsulating member. Disposing conductive material on the first surface of the encapsulating member, in the first trenches and in the first grounding trenches to form a conductive layer. Patterning the conductive layer on the first surface of the encapsulating member to form a circuit layer. The circuit layer including at least one grounding pad, which electrically connected to the grounding structures. Forming a plurality of second trenches on a second surface of the encapsulating member corresponding to the first trenches, forming a plurality of second grounding trenches on a second surface of the encapsulating member corresponding to the first grounding trenches, the second surface being opposite the first surface of the encapsulating member. Forming conductive material in the second trenches, and electrically connecting to the conductive material in the first trenches to cooperatively form at least one shielding structure in the first and the second trenches. Forming conductive material in the second grounding trenches, and electrically connecting to the conductive material in the first grounding trenches to cooperatively form a plurality of grounding structures in the first and the second grounding trenches. Separating the encapsulating member into a plurality of packaged units by cutting through the grounding structures from the second surface of the encapsulating member. Forming an electromagnetic shielding layer on the external surfaces of the packaged unit with conductive material, and the electromagnetic shielding layer is electrically connected to the grounding pads.

In summary, the instant disclosure provides a manufacturing method of package device, in which electronic components are fixed onto a substrate carrier, and an encapsulating member is disposed on the surface of the substrate carrier to cover the electronic components. The substrate carrier is then separated from the encapsulating member. First trench is then formed on a first surface of the encapsulating member. Conductive material is disposed on the first surface of the encapsulating member and the outer surface of the first trench to form a conductive layer. The conductive layer is patterned to form a circuit layer, so that the circuit layer is formed directly on the encapsulating member instead of a circuit board to reduce the volume of the packaging. Successively, second trench is formed on the second surface of the encapsulating member. The second trench and the first trench are interconnected. A shielding structure is then formed in the first and the second trenches to reduce the electromagnetic and radio frequency interferences between encapsulating compartments. An electromagnetic shielding layer is then formed and is electrically connected to grounding pads.

The electronic packaged device of the instant disclosure includes an encapsulating member and a shielding structure. The shielding structure is interposed between different encapsulating compartments to reduce the electromagnetic and radio frequency interferences between encapsulating compartments. The shielding structure can transmit electromagnetic interfering signals to the surrounding via grounding pads, and enhance the effects of electromagnetic shielding for the electronic packaged device.

In order to further understand the instant disclosure, the following embodiments and illustrations are provided. However, the detailed description and drawings are merely illustrative of the disclosure, rather than limiting the scope being defined by the appended claims and equivalents thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1**A to **1**K are cross-sectional views illustrating steps of an electronic packaged device manufacturing method in accordance with a first embodiment of the instant disclosure;

FIGS. **2**A to **2**C are cross-sectional views illustrating steps of the electronic packaged device manufacturing method in accordance with a second embodiment of the instant disclosure;

FIGS. **3**A to **3**D are cross-sectional views illustrating steps of the electronic packaged device manufacturing method in accordance with a third embodiment of the instant disclosure; and

FIG. **4** is a schematic diagram of an electronic packaged device in accordance with the first embodiment of the instant disclosure

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Please refer to FIGS. **1**A to **1**K as schematic diagrams illustrating steps of an electronic packaged device manufacturing method in accordance with a first embodiment of the instant disclosure.

As shown in FIG. **1**A, a plurality of electronic components **120** is configured on a surface of a substrate carrier B**1**. Adhesives A**1** are applied onto the surface of the substrate carrier B**1** to fix the electronic components **120** on the substrate carrier B**1**. Notably, the electronic components **120** can be chips, transistors, diodes, capacitors, inductors, or the like. The adhesives A**1** can be glue, double sided tape, adhesive inks or the like. However, the coupling between the electronic components **120** and the substrate carrier B**1** is not limited to the examples provided herein.

Please refer to FIG. **1**B. An encapsulating member **130** is disposed on the surface of the substrate carrier to cover the electronic components **120**. Typically, the encapsulating member **130** can be molding sealant or prepreg adhesives. The encapsulating member **130** is at least partially adhered to the substrate carrier's B**1** surface and covers the electronic components **120**. The encapsulating member **130** has a first surface S**1** and a second surface S**2** opposite the first surface S**1**. In the instant embodiment, the first surface S**1** is the bottom surface of the encapsulating member **130** and the second surface S**2** is the top surface of the encapsulating member **130**. However, the first surface S**1** can be the top surface of the encapsulating member **130** and the second surface S**2** is the bottom surface of the encapsulating member **130** in another embodiment, and is not limited to the examples provided herein.

Please refer to FIG. **1**C. The adhesives A**1** are removed to separate the substrate carrier B**1** from the encapsulating member **130**. Typically, the adhesives can be mechanically removed by scraping or sanding as well as thermally treating the adhesives to remove the adhesiveness. Alternatively, solvents can be used to remove adhesives, but the removal of adhesives is not limited to the examples provided herein.

Please refer to FIG. **1**D. The manufacturing method of the electronic packaged device can further include forming a protective layer P**1** covering over the encapsulating member **130**. Specifically, before forming trenches on the surface of the encapsulating member **130**, the protective layer P**1** is formed on the surface of the encapsulating member **130** covering thereof at desired positions where the trenches are to be formed, in which minimizes contamination to post-processing procedures or structures by particles or powder generated during the formation of the trenches. Typically, the protective layer P**1** can be insulating ink coating or photoresist, but not limited to the examples provided herein. In the instant embodiment, the protective layer P**1** is formed on the first surface S**1**.

Please refer to FIG. **1**E. A plurality of first trenches T**1** and a plurality of first grounding trenches G**1** are formed in the encapsulating member **130**. Specifically, the first trenches T**1** and first grounding trenches G**1** are formed by laser L**1** ablation through the surface of the protective layer P**1** to portions of the encapsulating member **130**. A packaged unit U**1** is defined as a pre-determined region where a single packaged unit is obtained from the post process of singularization, and the single packaged unit is the electronic packaged device. Specifically, the first trenches T**1** are arranged at the regions between electronic components **120**, and the first grounding trenches G**1** are arranged between the packaged units U**1**. Notably, the first trenches T**1** and first grounding trenches G**1** are not formed through the second surface S**2** of the encapsulating member **130**.

To accommodate the specifications of electromagnetic shielding and various configurations of the electronic components **120**, the first trenches T**1** can be of various shapes and bends to divide into three or more encapsulating compartments **130***a* in an embodiment but is not limited to the example provided herein.

After the first trenches T**1** and first grounding trenches G**1** are formed by laser L**1** ablation, the protective layer P**1** is removed. Notably, during the laser ablation process, powder or particles are generated when portions of the encapsulating member **130** are being removed to form the first trenches T**1** and the first grounding trenches G**1**. Majority of those particles tends to stick onto the surface of the protective layer P**1**. As a result, solvent can be used to remove the protective layer P**1** as well as the particles.

Please refer to FIG. **1**F. Conductive material is disposed onto the first surface S**1** of the encapsulating member **130** and filled into the first trenches T**1** as well as the first grounding trenches G**1**. Specifically, the conductive material is disposed by spray coating, printing, electroplating or injection onto the first surface S**1** of the encapsulating member **130**, the first trenches T**1**, and the first grounding trenches G**1** to at least cover the surface of the first trenches T**1** and the first grounding trenches G**1**. In the instant embodiment, the conductive material covers the first surface S**1** to form a conductive layer **110'**. Moreover, the conductive material is also filled into the first trenches T**1** and the first grounding trenches G**1** to form a plurality of grounding structures **160**. Successively, the conductive material is cured for solidification.

Please refer to FIG. **1**G. The conductive layer **110'** on the first surface **S1** is patterned to form a circuit layer **110**. The circuit layer **110** includes at least one grounding pad **112** electrically connected to the grounding structure **160**. The circuit layer **110** also includes the ground connections to active components and passive components. Notably, the circuit layer **110** is a re-distribution layer. In other words, the circuit layer **110** is arranged on the bottom surface of the packaged unit U**1**, whereas the grounding pad **112** is re-layout on the surrounding of the bottom surface of the packaged unit U**1** in the instant embodiment. However, the grounding pad **112** can be arranged elsewhere due to various designs of the grounding circuits, and the arrangement of the grounding pad **112** is not limited to the examples provided herein.

Please refer to FIG. **1**H. A plurality of second trenches T**2** corresponding to the first trenches T**1** is formed on the second surface S**2** of the encapsulating member **130**. Before the plurality of second trenches T**2** is formed on the second surface S**2** of the encapsulating member **130**, a protective layer P**1** can be formed to cover the surface of the circuit layer **110**. Notably, in the following process of electromagnetic shielding formation, the protective layer P**1** can be first formed to cover the circuit layer **110** in order to prevent short circuiting due to contamination of the circuit layer **110**. Successively, removing portions of the encapsulating member **130** via laser L**1** ablation to form the second trenches T**2**. In the instant embodiment, the depths of the first trenches T**1** and the second trenches T**2** vary, where the depth of the first trenches T**1** is about 70% of the depth of the encapsulating member **130**. The first and the second trenches are interconnected to divide the encapsulating member **130** into at least two encapsulating compartments **130***a*.

Please refer to FIG. **1**I. Forming at least one shielding structure **140** in the first trenches T**1** as well as the second trenches T**2**. In the instant embodiment, conductive material **151** is spray coated or sputtered onto the second surface S**2** and onto outer surface of the second trenches T**2**. The conductive material on the surface of the second trench T**2** and the conductive material in the first trench T**1** are electrically connected to form the shielding structure **140**. Notably, the shielding structure **140** and the grounding pas **113** can be electrically connected according to the various grounding circuit designs.

Please refer to FIG. **1**J. The encapsulating member **130** is cut at the second surface S**2** corresponding to the grounding structures **160** to divide into the plurality of packaged units U**1**.

Please refer to FIG. **1**K. The electromagnetic shielding layer **150** is formed to cover the encapsulating member **130**. Since the plurality of packaged units U**1** are formed by cutting the encapsulating member **130** at the second surface S**2** corresponding to the grounding structures **160**, the grounding structures **160** are exposed at the sides of the packaged units U**1**. The exposed sides and top outer surfaces, also denoted as the external sides, of the packaged units U**1** are spray coated or sputter with conductive material thereon to form a continuous layer of electromagnetic shielding layer **150** across the exposed sides and top outer surfaces, or the external sides, of the packaged units U**1**. However, the formation of the electromagnetic shielding layer **150** is not limited to example provided herein. Notably, the electromagnetic shielding layer **150**, the grounding structure **160** and the grounding pads **112** are electrically connected. The protective layer P**1** is then removed with solvents to simultaneously remove powder or particles on the protective layer P**1**. The electronic packaged device **100** is substantially provided.

Notably, the electronic packaged device manufacturing method can be applied to wafer level chip scale package (WLCSP) to package chips without the need of a substrate carrier or PCB, which improves upon the need to have electrically connection with the substrate carrier as in the conventional flip chip or wire bonding technology and also reduces the overall packaging volume. Moreover, the electromagnetic shielding layer **150** and the grounding pads **112** of the instant disclosure are electrically connected to reduce the effects of electromagnetic and radio frequency interferences.

FIGS. **2**A to **2**C are schematic diagrams illustrating steps of the electronic packaged device manufacturing method in accordance with a second embodiment of the instant disclosure. The differences between the electronic packaged device method of the first and the second embodiments are further discloses as follows.

Please refer to FIG. **1**G in conjunction with FIG. **2**A as a continuation of the manufacturing method for the second embodiment. A plurality of second trenches T**2** and a plurality of second grounding trenches G**2** are formed on the second surface S**2** of the encapsulating member **130**. Specifically, laser L**1** ablation is applied to removed portions of the encapsulating member **130** to form the second trenches T**2** and second grounding trenches G**2** in the second embodiment. Notably, the second trenches T**2** correspond to and are interconnected to the first trenches T**1**, whereas the second grounding trenches G**2** corresponding to the first grounding trenches G**1** are electrically and physically connected to the first grounding trenches G**1** to divide into at least two encapsulating compartments **130***a*.

Please refer to FIG. **2**B. Conductive material **151** is formed on the second surface S**2**, and in the second trenches T**2** as well as second grounding trenches G**2** of the encapsulating member **130**. Specifically, conductive material **151** is spray coated or sputter or injection or printing on the second surface S**2**, and in the second trenches T**2** as well as second grounding trenches G**2** of the encapsulating member **130**. The conductive material **151** formed on the second surface S**2** of the encapsulating member **130** is an electromagnetic shielding layer **150**, whereas the conductive material **151** formed in the second trenches T**2** and the conductive material **151** formed in the first trenches T**1** are interconnected to form at least one shielding structure **240**, meanwhile, the conductive material **151** formed in the second grounding trenches G**2** and the conductive material **151** formed in the first grounding trenches G**1** are electrically connected to form a plurality of grounding structures **260**. Successively, the grounding structures **260** of the encapsulating member **130** are cut through from the second surface S**2** to divide into a plurality of packaged units U**1**.

Please refer to FIG. **2**C. The electromagnetic shielding layer **150** covering the second surface S**2** are physically connected to the shielding structures **240** and the grounding structures **260** disposed on sides of the electronic packaged devices **200**, whereas the electromagnetic shielding layer **150**, the shielding structures **240**, and the grounding structures **260** are electrically connected to each other. The electromagnetic shielding layer **150** on the surface of the packaged units U**1** provides electromagnetic shielding via the grounding structures **260**. The electromagnetic shielding layer **150** covers the encapsulating member **130** and is electrically connected to the grounding pads **112**.

Notably in the second embodiment, the shielding structure **240** and the grounding structure **260** are first formed on the sides of the uncut electronic packaged device **200** and then are cut to form the plurality of electronic packaged devices **200**, the protective layer P**1** is not necessary formed on outer surface of the circuit layer **110** when the second trenches T**2** are being formed. FIGS. **3**A to **3**D are schematic diagrams illustrating steps of the electronic packaged device manufacturing method in accordance with a third embodiment of the instant disclosure. The differences between the electronic packaged device method of the third and the second embodiments are further discloses as follows. Please refer to FIGS. **3**A to **3**D.

Please refer to FIG. **1**E in conjunction with FIG. **3**A as a continuation of the manufacturing method for the instant embodiment. A plurality of through holes V**1** is formed on the first trenches T**1** via laser L**1** ablation. The through holes V**1** have small diameters and formed from the first trenches T**1** through the encapsulating member **130** and to the second surface S**2**. Notably, the diameters of the through holes V**1** range from about 20 to 40 microns (μm).

Please refer to FIG. **3**B. Conductive material is disposed on the first surface S**1** and into the first trenches T**1** as well as in to the first grounding trenches G**1**. Specifically, conductivies materials are spray coated, printed, sputter, or injected on the first surface S**1** of the encapsulating member **130** as well as filling in the first trenches T**1** and the first grounding trenches G**1** to form the conductive layer **110'**. Suction is then provided from the second surface S**2** of the encapsulating member **130** via the through holes V**1**, such that the conductive material can smoothly flow into the first trenches T**1**. In the instant embodiment, the conductive material covers the first trenches T**1**, the surface of the first grounding trenches G**1**, as well as filling in the first trenches T**1** and the first grounding trenches G**1** to form the plurality of grounding structures **160**. Successively, the conductive material is cured for solidification.

Please refer to FIG. **3**C. The conductive layer **110'** of the first surface S**1** of the encapsulating member **130** is patterned to form a circuit layer **110**. The circuit layer **110** includes at least one grounding pad **112** electrically connected to the grounding structure **160**. Notably, the circuit layer **110** is a re-distribution layer in the instant embodiment.

Please refer to FIG. **3**D. Second trenches T**2** are formed on the second surface S**2** of the encapsulating member **130**. The second trenches T**2** are formed by removing portions of the encapsulating member **130** from the position proximate to the through holes V**1**. The second trenches T**2** and the first trenches T**1** are electrically connected. In the instant embodiment, the width of the first and the second trenches T**1**, T**2** are identical. However, the width of the first and second trenches T**1**, T**2** can be different and are not limited to the examples provides herein.

Please refer to FIGS. **1**I to IK as a continuation of the manufacturing method in FIG. **3**D for the instant embodiment.

Please refer to FIG. **4** as a schematic diagram of an electronic packaged device in accordance with the first embodiment of the instant disclosure. The electronic packaged device **100** includes a circuit layer **110**, a plurality of electronic components **120**, an encapsulating member **130**, a shielding structure **140**, at least one grounding structure **160**, and a electromagnetic shielding layer **150**. The electronic components **120** and the circuit layer **110** are electrically connected. The encapsulating member **130** covers at least one electronic component **120** and includes at least two encapsulating compartments **130***a*. The shielding structure **140** is interposed between different encapsulating compartments **130***a*, and the electromagnetic shielding layer **150** is formed on the encapsulating member **130**.

The circuit layer **110** includes grounding pads **112** and electric circuits. In the instant embodiment, the circuit layer **110** is a redistribution layer so the grounding pads **112** are re-layout proximate to the surrounding of the bottom surface of the packaged units U**1**. The grounding pads **112** and the electric circuits can be configured according to the arrangement of the electronic components.

Electronic components **120** can be of various kinds and are not necessarily identical. Examples of electronic components **120** can be chips, transistors, diodes, capacitors, inductors or the like. As shown in FIG. **4**, the electronic components **120** can be various sizes and shapes or types, and are not limited to the examples provides herein.

The encapsulating member **130** includes a first surface S**1** and an oppositely arranged second surface S**2**. In the instant embodiment, the first surface S**1** is the bottom surface of the encapsulating member **130** and is in contact with the circuit layer **110**, whereas the second surface S**2** is the top surface of the encapsulating member **130**. Notably, the first trenches T**1** and the second trenches T**2** are respectively formed on the first surface S**1** and the second surface S**2** of the encapsulating member **130**. The first trenches T**1** and the second trenches T**2** inwardly extend in the encapsulating member **130**, such that the first and the second trenches T**1**, T**2** are interconnected. The first and the second trenches T**1**, T**2** cooperatively defines a region therebetween as a trench F**1**. In other words, the trench F**1** extend through the top surface (second surface S**2**) of the encapsulating member **130** to the bottom surface (first surface S**1**) of the encapsulating member **130** to divide into at least two encapsulating compartments **130***a*.

In the instant embodiment, the encapsulating member **130** includes two encapsulating compartments **130***a* each covering at least one electronic component **120**. However, the encapsulating member **130** can include three or more encapsulating compartments **130***a* that can cover the electronic components **120**, but the number of components is not limited to the examples provided herein.

Notably, the encapsulating member **130** can be molding sealant to prevent unnecessary electrical connectivity, short circuiting, or the like. The encapsulating member **130** can be pre-impregnated material (prepreg) such as glass fiber prepreg, carbon fiber prepreg, epoxy resin, or the like.

The shielding structure **140** is disposed in the trench F**1** between the encapsulating compartments **130***a*. Specifically, the shielding structure **140** is disposed in the encapsulating member **130** and extends from the top surface to the bottom surface of the encapsulating member **130**, such that various encapsulating compartments **130***a* can be divided. In the instant embodiment, the shielding structure **140** includes a first portion **140***a* and a second portion **140***b*. Conductive material **151** is spray coated, printed, sputter, or injected into the first trench T**1** to form the first portion **140***a*, whereas conductive material **151** is spray coated or sputter on the outer surface of the second trench T**2** to form the second portion **104***b*. Notably, the conductive material on the outer surface of the second trench T**2** is electrically connected to the conductive material in the first trench T**1** In other words, the first portion **140***a* and the second portion **140***b* are electrically connected to form the shielding structure **140**.

Notably, the shielding structure **140** reduces electromagnetic and radio frequency interferences between the encapsulating compartments **130***a*. The shielding structure **140** provides further electromagnetic shielding of the electronic packaged device by transmitting electromagnetic interferences to the ground via the grounding pads **112**, and further enhances the effects of electromagnetic shielding between electronic components **120** covered in the encapsulating compartments **130***a*.

Notably, the shielding structure **140** is made of metal such as copper, aluminum, silver, nickel or the like. However, the shielding structure **140** can also be conductive polymers such as polyaniline (PAn), polypyrrole (PYy), polythiophene (PTh) or the like, and is not limited to the examples provided herein.

The electromagnetic shielding layer **150** is formed on the second surface **S2** and the exposed sides of the encapsulating member **130**. The electromagnetic shielding layer **150** is electrically connected to the second portion **140***b* of the shielding structure **140**. Specifically, the electromagnetic shielding layer **150** reduces surrounding electromagnetic interferences from the electronic components **120**. In the instant embodiment, the grounding structure **160** is exposed at the cut sides of the encapsulating member **130** and is electrically connected to the grounding pads **112**. The electromagnetic shielding layer **150** covers the top outer surface and exposed sides (the top outer surface and the exposed sides are denoted as the external sides) of the encapsulating member **130**. In another embodiment, the electromagnetic shielding layer **150** covers exposed sides of the grounding pads **112** and electrically connected to the grounding structure **160** and the grounding pads **112**, such that the electromagnetic shielding layer **150** can transmit electromagnetic interfering signals to the grounding pads **112** of the circuit layer **110**, and enhance electromagnetic shielding effects for the electronic packaged device. However, the electromagnetic shielding layer **150** can also cover only the top surface and the exposed sides of the encapsulating member **30** while not extended to the grounding pads **112**. As a result, the electromagnetic shielding layer **150** can transmit electromagnetic interfering signals to the ground via the grounding structure **160**.

The structure of the electronic packaged device in accordance with the instant disclosure can be applied to wafer level chip scale package (WLCSP) to package chips without the need of a substrate carrier or PCB, which improves upon the need to have electrically connection with the substrate carrier as in the conventional flip chip or wire bonding technology and also reduces the overall packaging volume. Moreover, the electromagnetic shielding layer **150** and the grounding pads **112** of the instant disclosure are electrically connected to reduce the effects of electromagnetic and radio frequency interferences.

Please refer to FIG. **2**C as schematic diagrams illustrating the structure of the electronic packaged device in accordance with the second embodiment of the instant disclosure. The electronic packaged device **200** and the electronic packaged device **100** are similar, so the differences will be disclosed as follow.

In the instant embodiment, the shielding structure **240** is formed by spray coating, sputtering, printing, injection or the like to fill the trench **F1** with conductive material. The shielding structure **240** extends from the first surface **S1** (bottom surface) to the second surface **S2** (top surface) of the encapsulating member **130** and is electrically connected to the electromagnetic shielding layer **150**.

Moreover, the electromagnetic shielding layer **150** covers the second surface **S2** of the encapsulating member **130** to electrically connect to the shielding structure **240**, and the electromagnetic shielding layer **150** is physically and electrically connected to the grounding structure **260** at the sides of the electronic packaged device **200**. The sides of the electronic packaged device **200** are electromagnetic shielded by the grounding structure **260**. The electromagnetic shielding

layer **150** covers the encapsulating member **130** and is electrically connected to the grounding pads **112**.

In summary, the instant disclosure provides a package device manufacturing method. Electronic components are fixed onto a substrate carrier by adhesives, and an encapsulating member is disposed on the surface of the substrate carrier to cover the electronic components. The substrate carrier is then separated from the encapsulating member. First trench is then formed on a first surface of the encapsulating member. Conductive material is disposed on the first surface and the outer surface of the first trench to form a conductive layer. The conductive layer is patterned to form a circuit layer, so that the circuit layer is formed directly on the encapsulating member instead of a circuit board to reduce the volume of the packaging. Successively, second trench is formed on the second surface of the encapsulating member. The second trench and the first trench are interconnected. A shielding structure is then formed in the first and the second trenches to reduce the electromagnetic and radio frequency interferences between encapsulating compartments. An electromagnetic shielding layer is then formed and is electrically connected to grounding pads.

The electronic packaged device of the instant disclosure includes an encapsulating member and a shielding structure. The shielding structure is interposed between different encapsulating compartments to reduce the electromagnetic and radio frequency interferences between encapsulating compartments. The shielding structure can transmit electromagnetic interfering signals to the surrounding via grounding pads, and enhance electromagnetic shielding for the electronic packaged device.

The figures and descriptions supra set forth illustrated the preferred embodiments of the instant disclosure; however, the characteristics of the instant disclosure are by no means restricted thereto. All changes, alternations, combinations or modifications conveniently considered by those skilled in the art are deemed to be encompassed within the scope of the instant disclosure delineated by the following claims.

What is claimed is:

1. An electronic package device manufacturing method, comprising:

configuring a plurality of electronic components on a surface of a substrate carrier; forming an encapsulating member on the surface of the substrate carrier to cover the electronic components; separating the substrate carrier from the encapsulating member; forming a plurality of first trenches and a plurality of first grounding trenches on a first surface of the encapsulating member; disposing conductive material on the first surface of the encapsulating member, in the first trenches, and in the first grounding trenches to form a conductive layer and a plurality of grounding structures; patterning the conductive layer on the first surface to form a circuit layer, wherein the circuit layer includes at least one grounding pad electrically connected to the grounding structures; forming a plurality of second trenches on a second surface of the encapsulating member corresponding to the first trenches, the second surface being opposite the first surface of the encapsulating member; forming conductive material in the second trenches, and electrically connecting the conductive material in the second trenches and the conductive material in the first trenches to cooperatively form at least one shielding structure in the first and the second trenches; separating the encapsulating member into a plurality of packaged units by cutting through the grounding structures of the encapsulating member; and forming an electromagnetic shielding layer on external surfaces of each of the packaged units with conductive material; wherein the electromagnetic shielding layer is electrically connected to the at least one grounding pad.

2. The method as recited in claim **1**, wherein the formation of the second trenches comprising:

removing portions of the encapsulating member from the second surface so as to interconnect the first and the second trenches and define at least two encapsulating compartments.

3. The method as recited in claim **1**, further comprising:

forming a plurality of through holes by removing portions of the encapsulating member in the first trenches after the step of forming the first trenches and the first grounding trenches.

4. The method as recited in claim **3**, wherein the step of disposing conductive material on the first surface of the encapsulating member and in the first trenches further comprising:

providing suction through the through holes from the second surface of the encapsulating member.

5. The method as recited in claim **4**, wherein the step of forming the second trenches comprising:

removing portions of the encapsulating member from the second surface proximate to the through holes to remove the through holes and interconnect the first and the second trenches.

6. The method as recited in claim **1** further comprising:

forming a protective layer to cover the encapsulating member before the step of forming the first trenches and the first grounding trenches.

7. The method as recited in claim **6** further comprising:

removing the protective layer after the step of forming the first trenches and the first grounding trenches.

8. The method as recited in claim **1** further comprising:

forming a protective layer to cover the circuit layer before the step of forming the second trenches corresponding to the first trenches on the second surface of the encapsulating member.

9. The method as recited in claim **8** further comprising:

removing the protective layer after the step of forming an electromagnetic shielding layer on external surfaces of the packaged units with conductive material.

10. The method as recited in claim **1**, wherein the first trenches and the second trenches have different depths.

11. An electronic package device manufacturing method, comprising: configuring a plurality of electronic components on a surface of a substrate carrier; forming an encapsulating member on the surface of the substrate carrier to cover the electronic components; separating the substrate carrier from the encapsulating member; forming a plurality of first trenches and a plurality of first grounding trenches on a first surface of the encapsulating member; disposing conductive material on the first surface of the encapsulating member, in the first trenches and in the first grounding trenches to form a conductive layer; patterning the conductive layer on the first surface to form a circuit layer, wherein the circuit layer includes at least one grounding pad; forming a plurality of second trenches on a second surface of the encapsulating member corresponding to the first trenches, and forming a plurality of second grounding trenches on the second surface of the encapsulating member corresponding to the first grounding trenches; forming conductive material in the second trenches, electrically connecting the conductive material in the second trenches and the conductive material in the first trenches to cooperatively form at least one shielding structure in the first and the second trenches, forming conductive material in the second grounding trenches, and electrically connecting the conductive material in the second grounding trenches an the conductive material in the first grounding trenches to cooperatively form a plurality of grounding structures in the first and the second grounding trenches; and separating the encapsulating member into a plurality of packaged units by cutting through the grounding structures of the encapsulating member; wherein each of the packaged units has an electromagnetic shielding layer covering the encapsulating member and electrically connected to the at least one grounding pad.

12. The method as recited in claim **11**, wherein the step of forming the second trenches and the second grounding trenches comprising:

removing portions of the encapsulating member from the second surface thereof to interconnect the first and the second trenches, and removing portions of the encapsulating member from the second surface thereof to interconnect the first and the second grounding trenches.

13. The method as recited in claim **11** further comprising:

forming a protective layer to cover the encapsulating member before the step of forming the first trenches and the first grounding trenches.

14. The method as recited in claim **13** further comprising:

removing the protective layer after the step of forming the first trenches and the first grounding trenches.

15. The method as recited in claim **11**, wherein the first trenches and the second trenches have different depths.

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