US012389095B2

(12) **United States Patent**
Shin

(10) **Patent No.: US 12,389,095 B2**
(45) **Date of Patent: Aug. 12, 2025**

(54) **CAMERA MODULE INCLUDING AN IMAGE SENSOR**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 61 days.

(21) Appl. No.: **18/262,847**

(22) PCT Filed: **Jan. 25, 2022**

(86) PCT No.: **PCT/KR2022/001309**
§ 371 (c)(1),
(2) Date: **Jul. 25, 2023**

(87) PCT Pub. No.: **WO2022/158941**
PCT Pub. Date: **Jul. 28, 2022**

(65) **Prior Publication Data**

US 2024/0089570 A1 Mar. 14, 2024

(30) **Foreign Application Priority Data**

Jan. 25, 2021 (KR) 10-2021-0010417

(51) **Int. Cl.**
H04N 23/52 (2023.01)
H04N 23/54 (2023.01)
(Continued)

(52) **U.S. Cl.**
CPC ***H04N 23/52*** (2023.01); ***H04N 23/54*** (2023.01); ***H04N 25/77*** (2023.01);
(Continued)

(58) **Field of Classification Search**
CPC H04N 23/52; H04N 23/54; H04N 25/77; H04N 23/57; H05K 1/0271;
(Continued)

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Primary Examiner — Padma Haliyur
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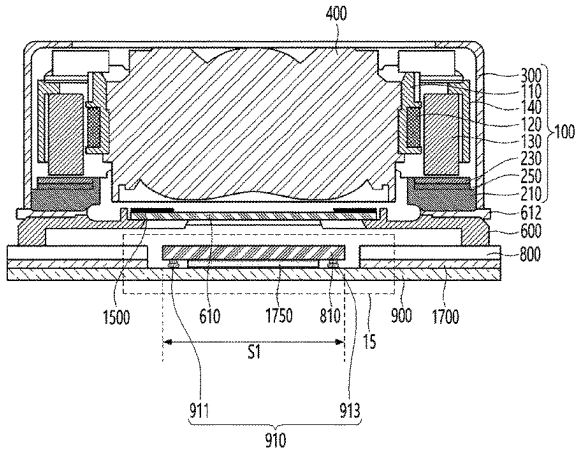
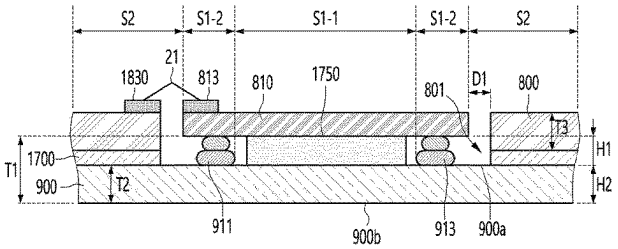
(57) **ABSTRACT**

A camera module according to an embodiment includes a reinforcing plate; a bump part disposed on the reinforcing plate; a substrate disposed on the reinforcing plate and including a cavity vertically overlapping the bump part; and an image sensor disposed on the bump part, wherein the bump part includes a first bump disposed on the reinforcing plate and having a first height; and a second bump disposed on the first bump and having a second height different from the first height; and wherein an upper surface of the second bump is in direct contact with a lower surface of the image sensor.

20 Claims, 11 Drawing Sheets





(51) **Int. Cl.**
H04N 25/77 (2023.01)
H05K 1/02 (2006.01)

(52) **U.S. Cl.**
CPC . ***H05K 1/0271*** (2013.01); *H05K 2201/10151* (2013.01); *H05K 2201/10287* (2013.01)

(58) **Field of Classification Search**
CPC H05K 2201/10151; H05K 2201/10287; H05K 2201/10083; H05K 3/0061; H05K 3/4007
See application file for complete search history.

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FIG. 1

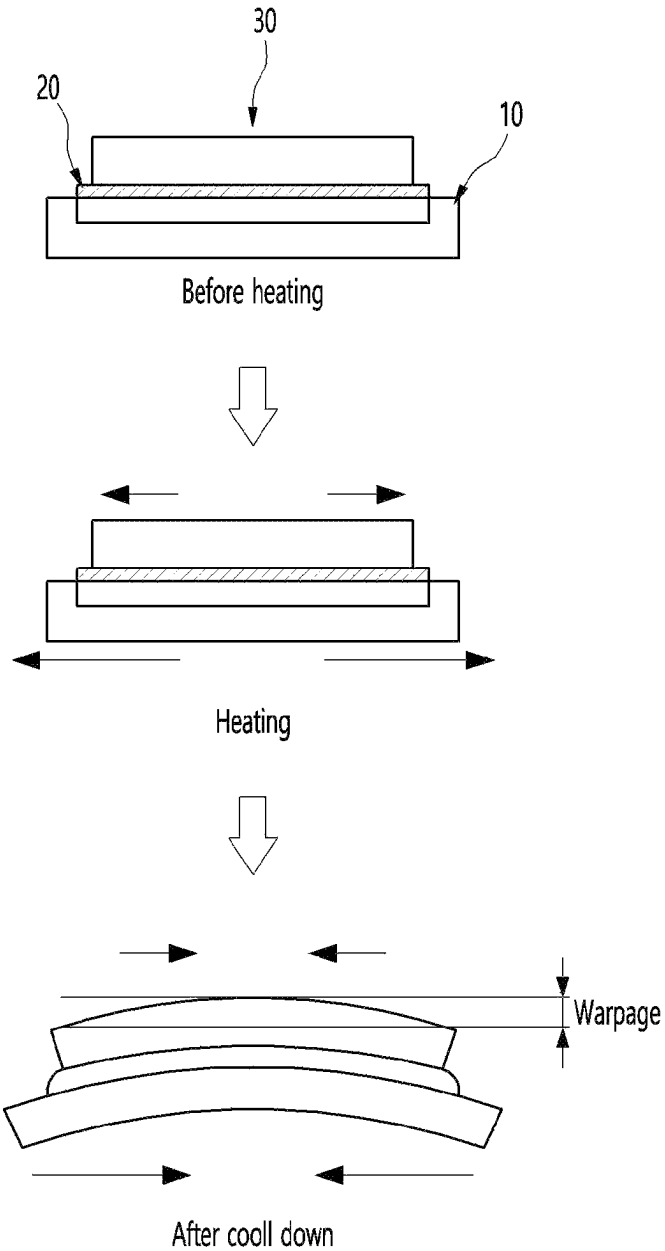


FIG. 2

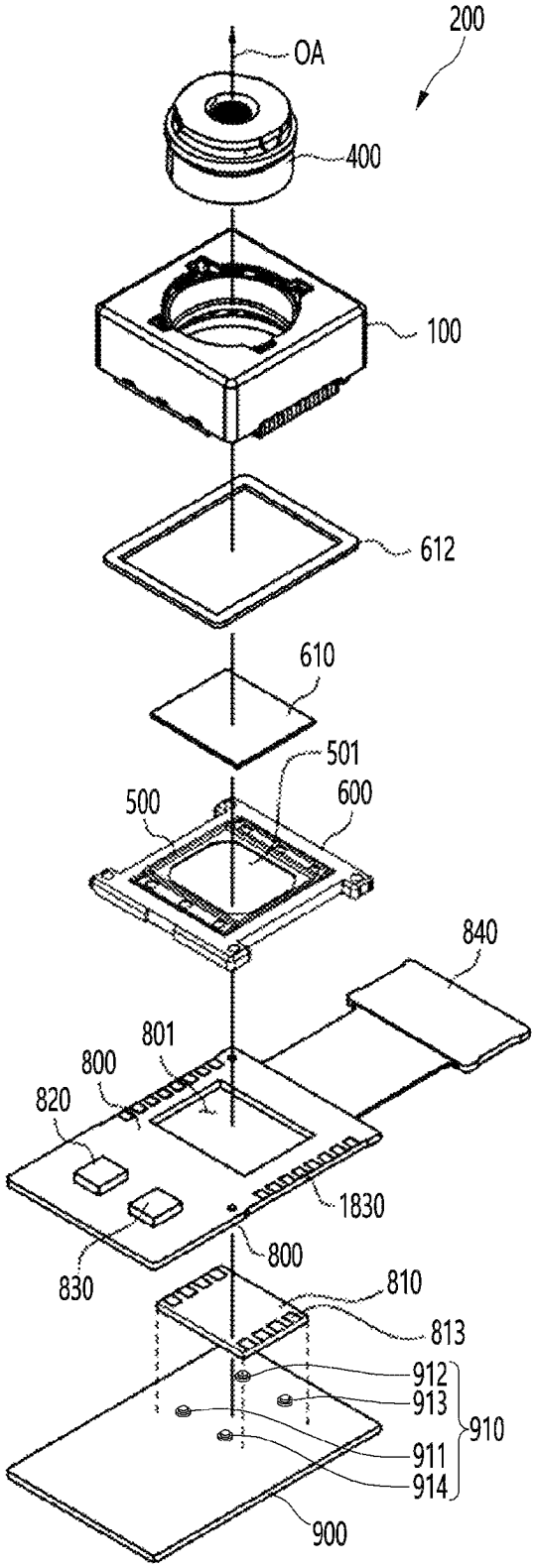

200
OA
400
100
612
610
501
600
500
840
801
800
820
1830
800
830
810
813
912
913
910
911
914
900

FIG. 3

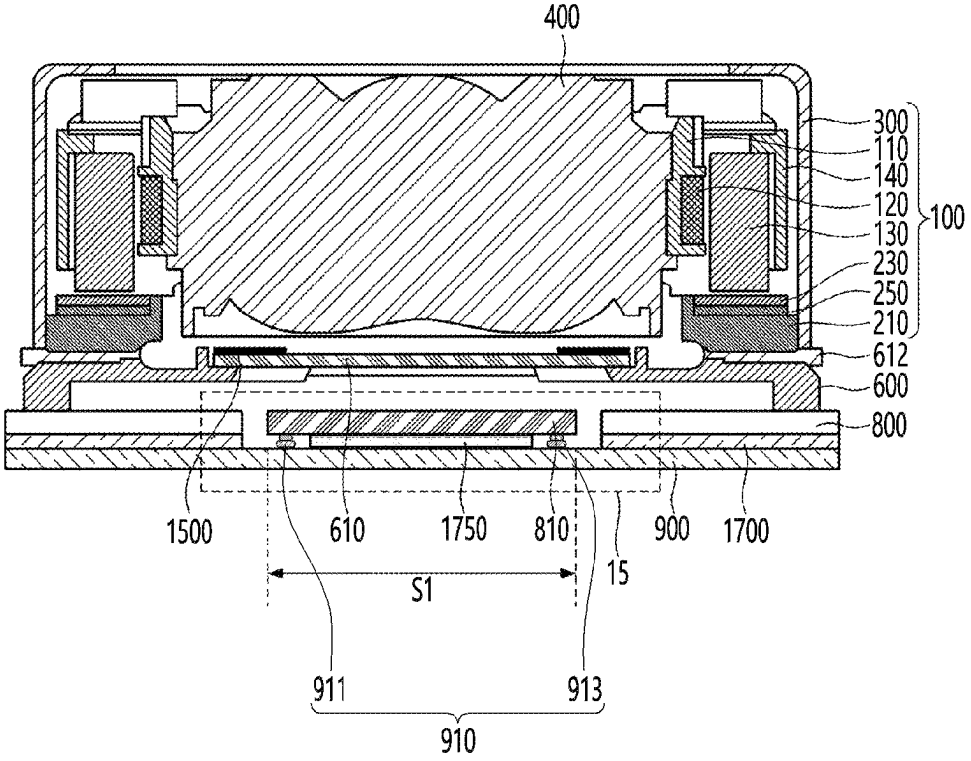

400
300
110
140
120
130
100
230
250
210
612
600
800
1500
610
1750
810
900
1700
15
S1
911
913
910

FIG. 4

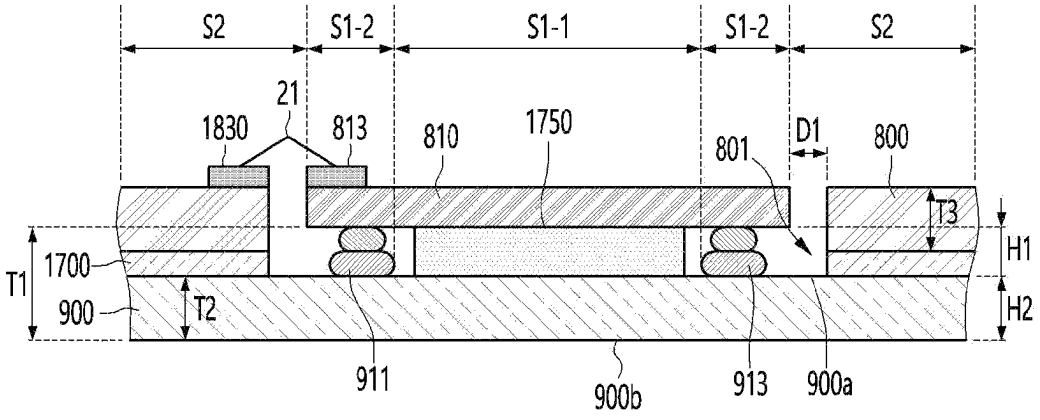

S2
S1-2
S1-1
S1-2
S2
21
1830
813
810
1750
801
D1
800
T3
H1
T1
1700
900
T2
H2
911
900b
913
900a

FIG. 5

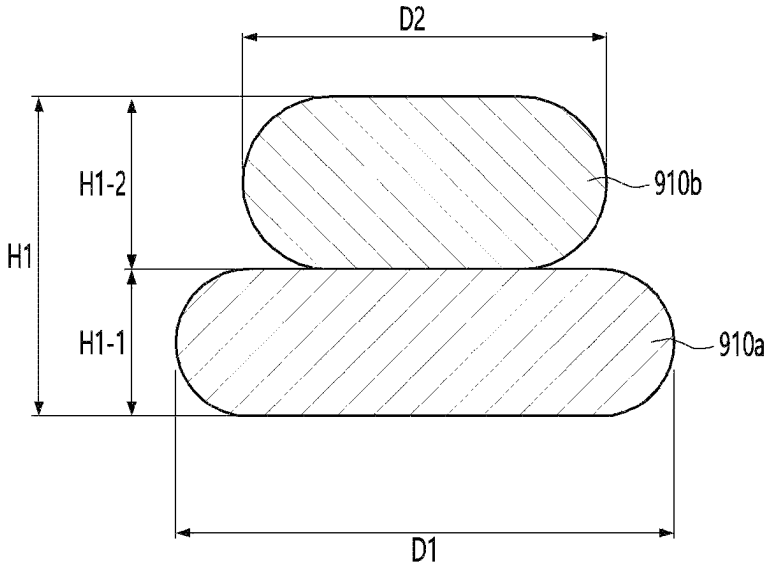


FIG. 6

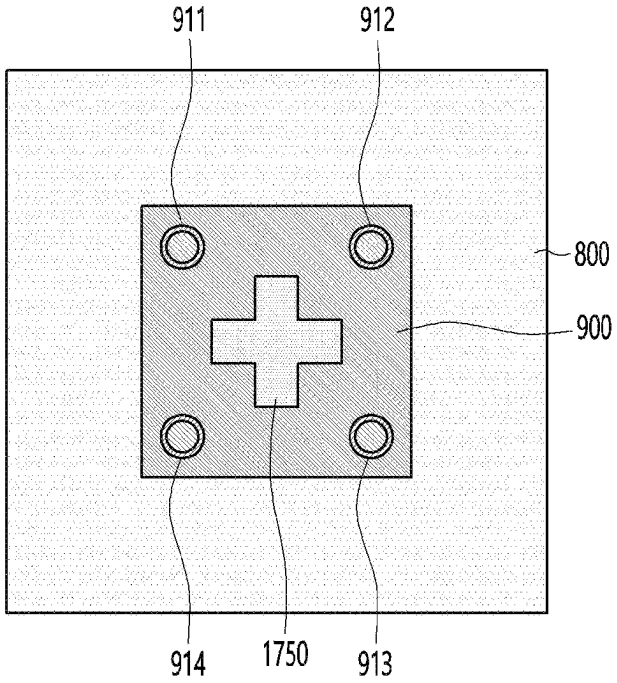
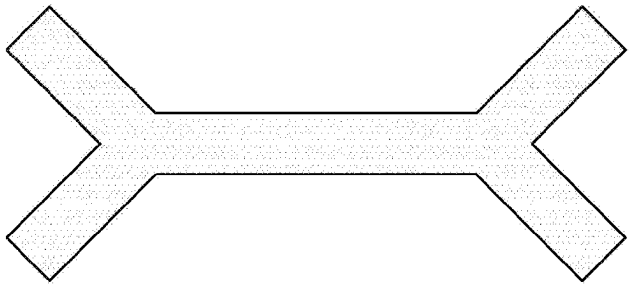
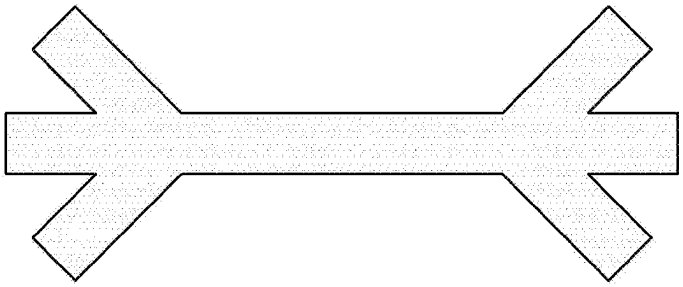


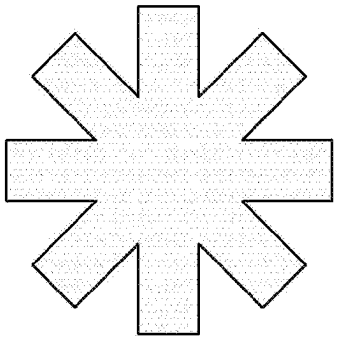
FIG. 7



(a)



(b)



(c)

FIG. 8

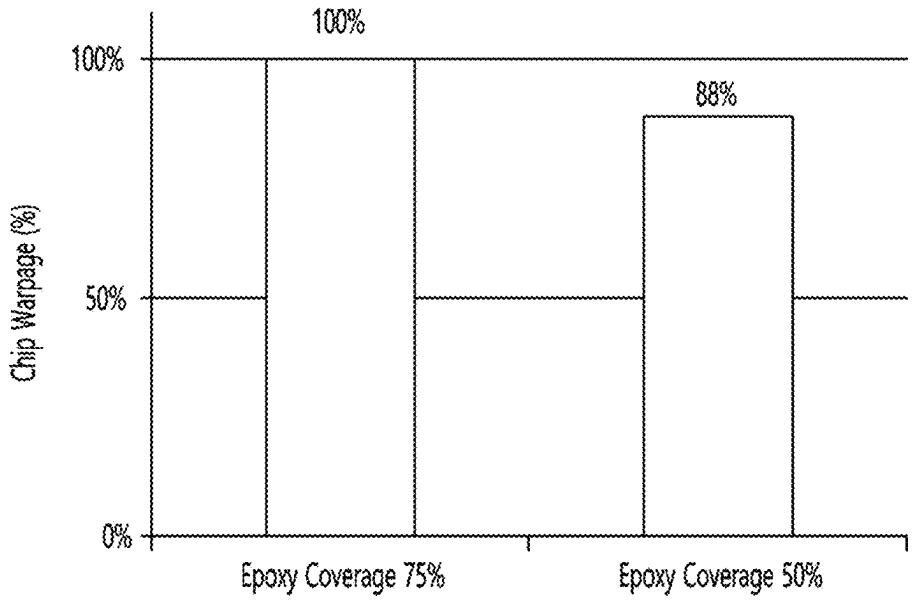

100%
100%
88%
Chip Warpage (%)
50%
0%
Epoxy Coverage 75%
Epoxy Coverage 50%

FIG. 9

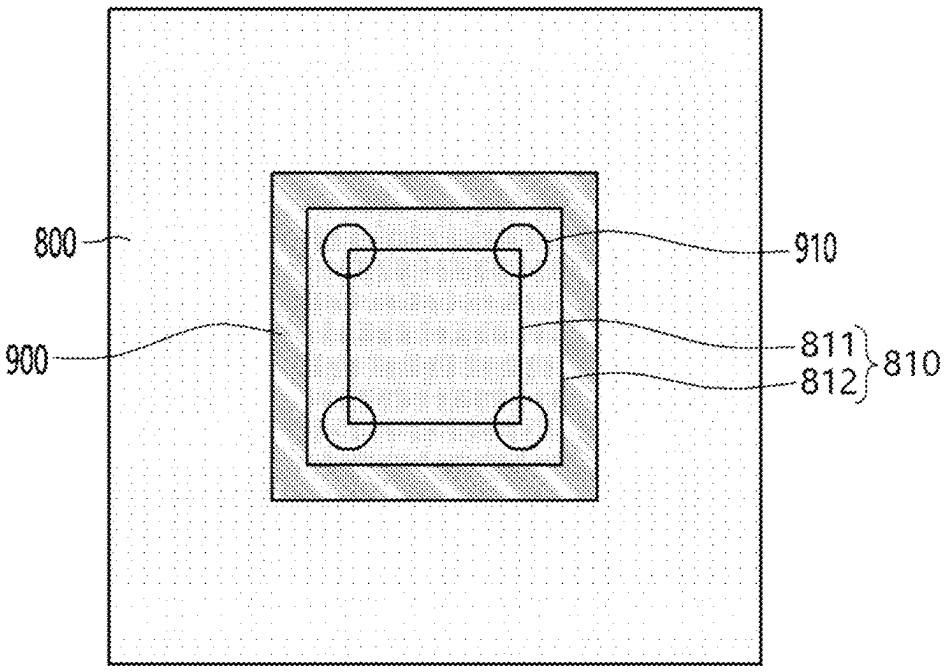

800
900
910
811
812
810

FIG. 10

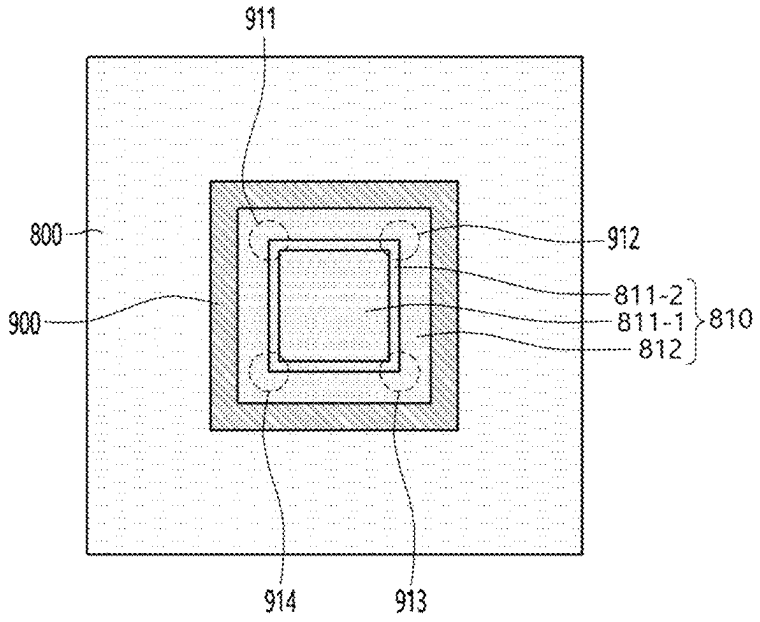

911
800
912
811-2
900
811-1
810
812
914
913

FIG. 11

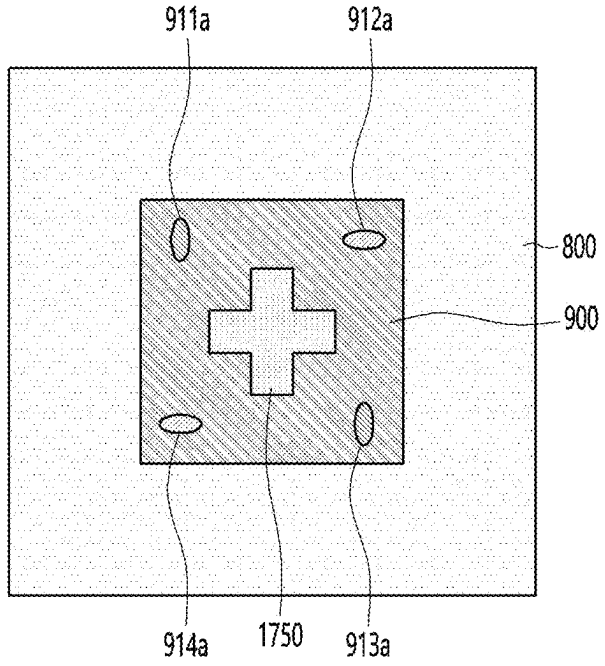

911a
912a
800
900
914a
1750
913a

FIG. 12

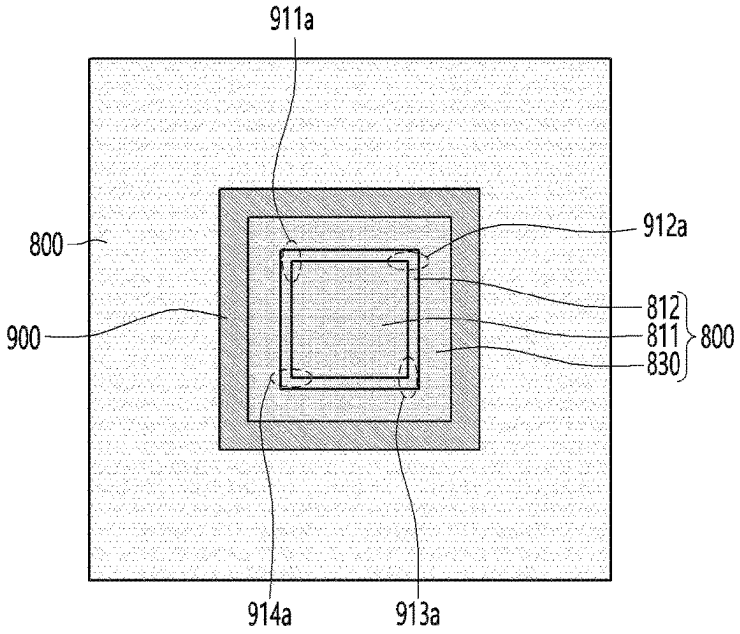

911a
800
912a
812
811
830
800
900
914a
913a

FIG. 13

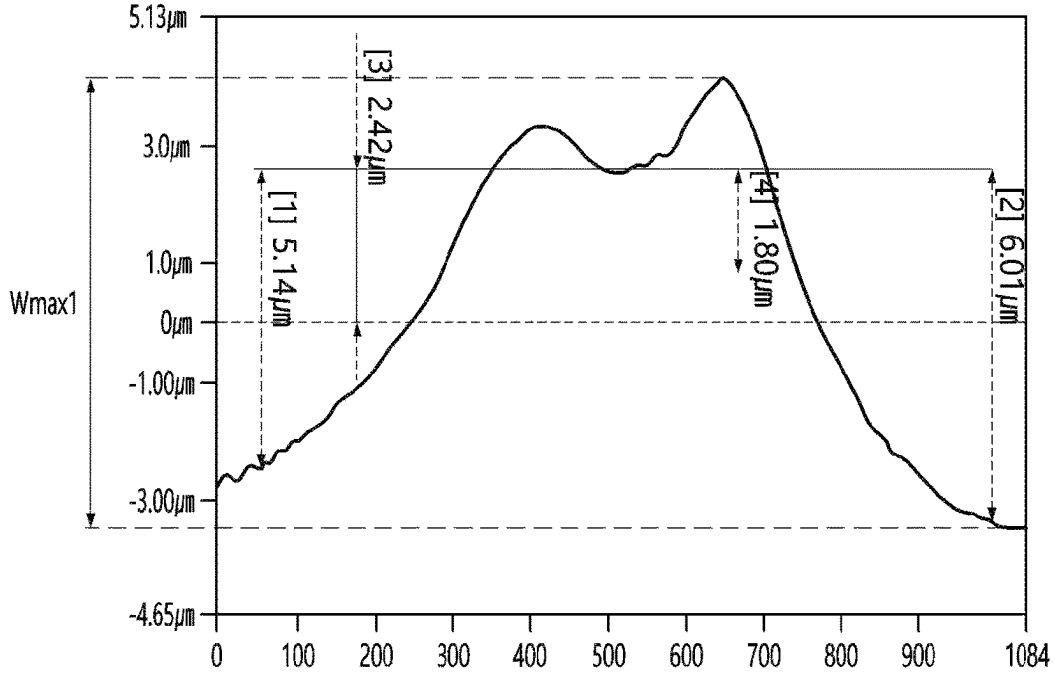
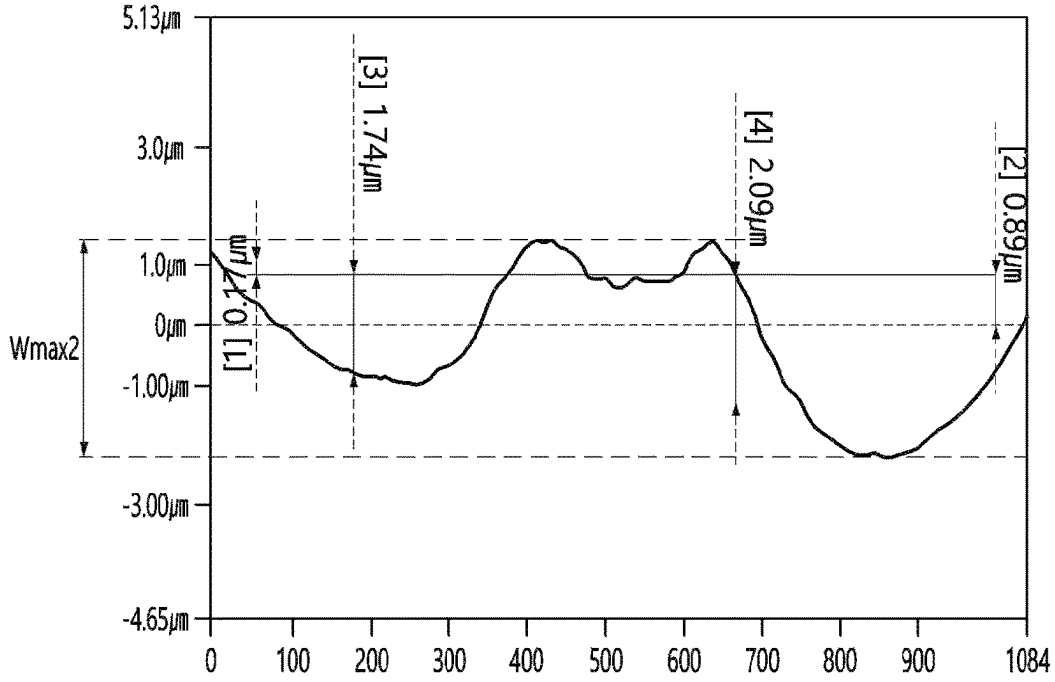

5.13μm
3.0μm
1.0μm
0μm
-1.00μm
-3.00μm
-4.65μm
Wmax1
[3] 2.42μm
[1] 5.14μm
[4] 1.80μm
[2] 6.01μm
0
100
200
300
400
500
600
700
800
900
1084

FIG. 14


5.13μm
3.0μm
1.0μm
0μm
-1.00μm
-3.00μm
-4.65μm
Wmax2
[1] 0.17μm
[3] 1.74μm
[4] 2.09μm
[2] 0.89μm
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300
400
500
600
700
800
900
1084

FIG. 15

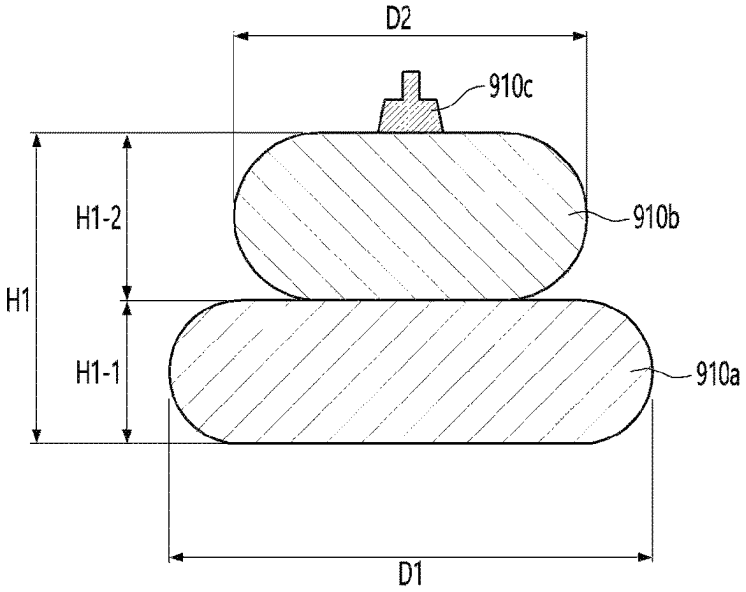

D2
910c
910b
910a
H1
H1-2
H1-1
D1

FIG. 16

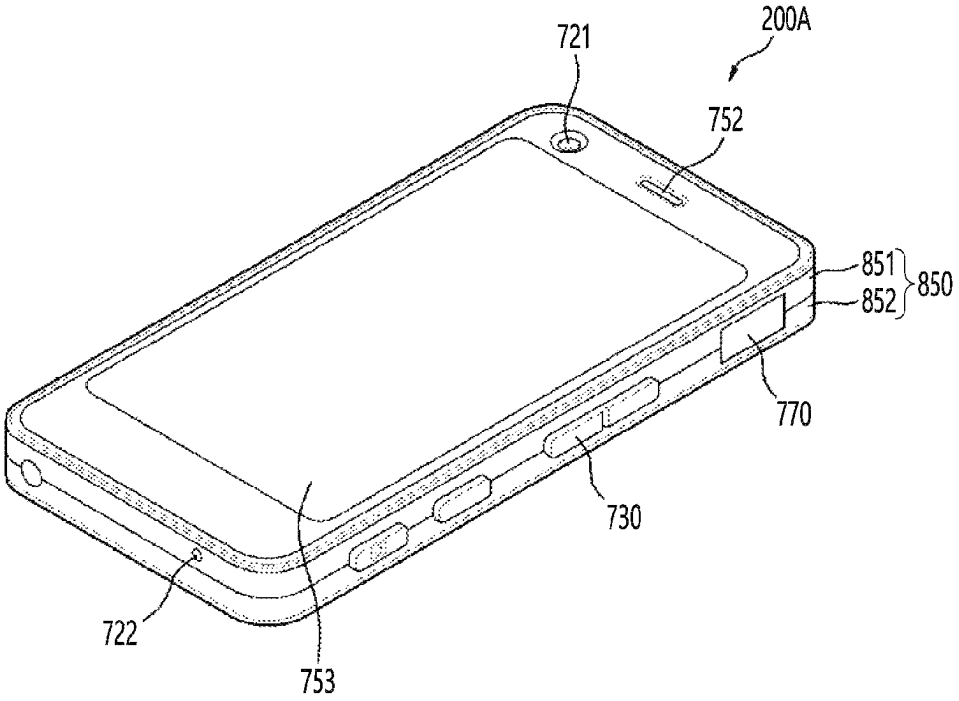
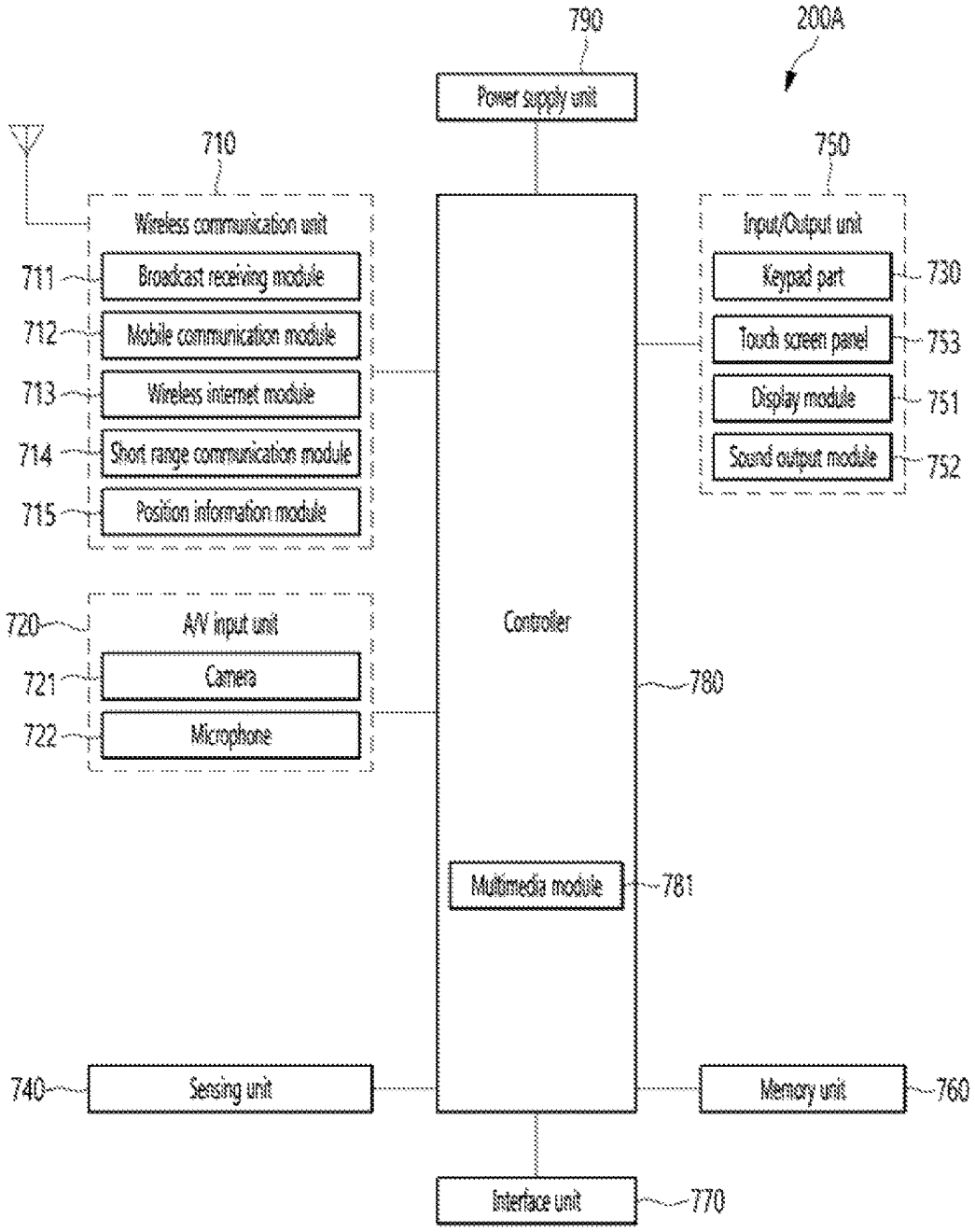


FIG. 17


790
200A
Power supply unit
710
750
Wireless communication unit
Input/Output unit
711
Broadcast receiving module
Keypad part
730
712
Mobile communication module
Touch screen panel
733
713
Wireless internet module
Display module
751
714
Short range communication module
Sound output module
752
715
Position information module
720
A/V input unit
Controller
721
Camera
780
722
Microphone
Multimedia module
781
740
Sensing unit
Memory unit
760
Interface unit
770

CAMERA MODULE INCLUDING AN IMAGE SENSOR

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is the U.S. national stage application of International Patent Application No. PCT/KR2022/001309, filed Jan. 25, 2022, which claims the benefit under 35 U.S.C. § 119 of Korean Application No. 10-2021-0010417, filed Jan. 25, 2021, the disclosures of each of which are incorporated herein by reference in their entirety.

TECHNICAL FIELD

An embodiment relates to a camera module and an optical device including the same.

BACKGROUND ART

Recently, miniature camera modules have been developed, and the miniature camera modules are widely used in small electronic products such as smart phones, notebook computers, and game devices.

That is, most mobile electronic devices, including smartphones, are equipped with a camera device for obtaining an image from an object, and the mobile electronic devices are gradually becoming smaller for easy portability.

Such a camera device generally may include a lens through which light is incident, an image sensor that captures light incident through the lens, and a plurality of components for transmitting and receiving electrical signals for images obtained from the image sensor to an electronic device equipped with a camera device. In addition, these image sensors and components are generally mounted on a printed circuit board and connected to an external electronic device.

On the other hand, the conventional camera device uses a printed circuit board so that the image sensor is located at a high position. However, when the image sensor is directly mounted on the printed circuit board as described above, there is a problem in that heat generated from the image sensor is not emitted, and thus there is a reliability problem due to heat generation. Recently, the pixels or size of image sensors are increasing for high resolution, and thus the heat problem of the image sensor further affects the performance of the camera device.

In addition, a printed circuit board in a conventional camera device is disposed on a reinforcing plate such as a stiffener, and the image sensor is disposed on the reinforcing plate, and then is connected to the printed circuit board through wire bonding. In this case, a cavity exposing a surface of the reinforcing plate is formed in the printed circuit board. In this case, when the cavity type printed circuit board and the reinforcing plate are used, the heat dissipation problem can be solved while increasing the height of the image sensor. In such a camera device, an epoxy for bonding an image sensor is applied on the reinforcing plate, and the image sensor is disposed on the applied epoxy. However, the camera device as described above has a problem in that warpage occurs due to a difference between a coefficient of thermal expansion of the image sensor, a coefficient of thermal expansion of the printed circuit board, and a coefficient of thermal expansion of the epoxy. For example, thermal curing proceeds in a state in which an image sensor is disposed on the epoxy. In this case, when the thermal curing proceeds, the configuration including the reinforcing plate, the epoxy and the image sensor is heat-expanded and then contracted, and accordingly, there is a problem that the warpage phenomenon occurs severely in a shape like '∩'. In addition, when the warpage phenomenon of the image sensor occurs, there is a problem in that the resolution performance of the camera device is deteriorated, and thus the yield of the camera device is decreased.

Accordingly, there is a need for a method capable of minimizing the warpage of the image sensor.

DISCLOSURE

Technical Problem

An embodiment is to provide a camera module capable of minimizing the warpage phenomenon of an image sensor and an optical device including the same.

In addition, the embodiment provides a camera module capable of supporting an image sensor using a bump formed of a metal wire and an optical device including the same.

Technical problems to be solved by the proposed embodiments are not limited to the above-mentioned technical problems, and other technical problems not mentioned may be clearly understood by those skilled in the art to which the embodiments proposed from the following descriptions belong.

Technical Solution

A camera module according to an embodiment comprises a reinforcing plate; a bump part disposed on the reinforcing plate; a substrate disposed on the reinforcing plate and including a cavity vertically overlapping the bump part; and an image sensor disposed on the bump part, wherein the bump part includes a first bump disposed on the reinforcing plate and having a first height; and a second bump disposed on the first bump and having a second height different from the first height; and wherein an upper surface of the second bump is in direct contact with a lower surface of the image sensor.

In addition, the reinforcing plate includes a region vertically overlapping the cavity, and the bump part is disposed in plurality on the region vertically overlapping the cavity among the upper surface of the reinforcing plate.

In addition, the bump part is not electrically connected to the image sensor.

In addition, the bump part is composed of a metal wire having a diameter in a range of 22 μm to 28 μm.

In addition, the first height of the first bump satisfies a range of 50% to 90% of the diameter of the metal wire.

In addition, the second height of the second bump satisfies a range of 115% to 170% of the diameter of the metal wire.

In addition, the first height of the first bump satisfies a range of 11 μm to 26 μm.

In addition, the second height of the second bump satisfies a range of 28 μm to 44 μm.

In addition, the first bump has a first width, and the second bump has a second width smaller than the first width.

In addition, the first width of the first bump satisfies a range of 70 μm to 97 m; and the second width of the second bump satisfies a range of 50 μm to 80 μm.

In addition, the camera module further comprises a first adhesive member disposed between the image sensor and the reinforcing plate; and a second adhesive member disposed between the substrate and the reinforcing plate.

In addition, an area of the first adhesive member is 50% or less of an area of the image sensor.

In addition, the plurality of bump parts overlap a corner region of the lower surface of the image sensor in an optical axis direction.

In addition, the bump part is spaced apart from an inner wall of the cavity of the substrate by a first separation distance.

In addition, the image sensor includes a pixel region and a passivation region around the pixel region, and the bump part overlaps the pixel region of the image sensor in an optical axis direction.

In addition, the pixel region of the image sensor includes an active pixel region; and a dummy pixel region between the active pixel region and the passivation region, wherein at least a portion of the second bump of the bump part overlaps the active pixel region in an optical axis direction.

In addition, the substrate includes a first terminal, the image sensor includes a second terminal, and a connection wire electrically connecting the first terminal and the second terminal, and wherein the connection wire is composed of the metal wire constituting the bump part.

Meanwhile, an optical device according to an embodiment comprises a main body; a camera module disposed in the main body and capturing an image of a subject; and a display unit disposed on the main body and outputting an image captured by the camera module, wherein the camera module includes a reinforcing plate; a substrate disposed on the reinforcing plate and including a cavity and a first terminal; a bump part disposed on the reinforcing plate and exposed through the cavity of the substrate; an image sensor disposed on the bump part and including a second terminal; and a wire part connecting the first terminal and the second terminal, wherein the bump part includes a first bump disposed on the reinforcing plate and having a first height; and a second bump disposed on the first bump and having a second height different from the first height, wherein an upper surface of the second bump is in direct contact with a lower surface of the image sensor, wherein the bump part is composed of a metal wire having a diameter in a range of 22 μm to 28 μm, wherein the first height of the first bump satisfies a range of 50% to 90% of the diameter of the metal wire, and wherein the second height of the second bump satisfies a range of 115% to 170% of the diameter of the metal wire.

Effects of the Invention

A camera module and an optical device including the camera module according to the embodiment include a bump part. The bump part may be formed by bonding a metal wire on a reinforcing plate. In this case, a region overlapping the image sensor in an optical axis direction among the upper surface of the reinforcing plate includes a region in which the bump part is disposed, and a region in which an adhesive member for attaching or fixing the image sensor is disposed. In other words, the adhesive member may be selectively disposed on a region of the upper surface of the reinforcing plate in which the bump part is not formed. In addition, the embodiment may be attached or fixed on the reinforcing plate by the adhesive member in a state in which at least a portion of the lower surface of the image sensor is in direct contact with and supported by the bump part. Accordingly, the embodiment may minimize a warpage phenomenon of the image sensor by allowing at least a part of the image sensor to directly contact and support the bump part, thereby improving the operation reliability of the camera module.

Furthermore, in the embodiment, at least a portion of the image sensor is in direct contact with the bump part, and the bump part is in direct contact with the reinforcing plate, so that heat generated from the image sensor can be efficiently transferred to the outside.

In addition, the embodiment allows an area of the adhesive member disposed on the lower surface of the image sensor to be smaller than an area of the lower surface of the image sensor. Accordingly, the embodiment may minimize the warpage phenomenon of the image sensor that occurs as an arrangement area of the adhesive member increases compared to the area of the image sensor.

In addition, the embodiment allows at least a portion of an edge region of an active pixel region of the image sensor to be supported by the bump part in the optical axis direction. Accordingly, the embodiment may secure the flatness of the active pixel region, thereby improving the quality of the image obtained by the image sensor.

DESCRIPTION OF DRAWINGS

FIG. **1** is a view for explaining a warpage phenomenon of a camera module of a comparative example.

FIG. **2** is an exploded perspective view of a camera module according to an embodiment.

FIG. **3** is a cross-sectional view of the camera module of FIG. **1** according to an embodiment.

FIG. **4** is an enlarged view of a dotted line portion of FIG. **3**, and FIG. **5** is an enlarged view of a bump part according to an embodiment.

FIG. **6** is a plan view showing a circuit board, a reinforcing plate, a bump part, and a first adhesive member before an image sensor according to the first embodiment is attached.

FIG. **7** is a view illustrating various embodiments of an arrangement shape of a first adhesive member.

FIG. **8** is a view illustrating a degree of occurrence of warpage according to an arrangement area of a first adhesive member.

FIGS. **9** and **10** are views illustrating an arrangement relationship between a bump part and the image sensor according to a first embodiment.

FIG. **13** is a graph illustrating a degree of warpage of an image sensor according to a comparative example.

FIG. **14** is a graph illustrating a degree of warpage of an image sensor including a bump part according to an embodiment.

FIG. **15** is a view illustrating a shape of a bump part according to another embodiment.

FIG. **16** is a perspective view of a portable terminal according to an embodiment.

FIG. **17** is a block diagram of the portable terminal shown in FIG. **16**.

BEST MODE

Hereinafter, embodiments of the present invention will be described in detail with reference to the accompanying drawings.

However, the spirit and scope of the present invention is not limited to a part of the embodiments described, and may be implemented in various other forms, and within the spirit

and scope of the present invention, one or more of the elements of the embodiments may be selectively combined and replaced.

In addition, unless expressly otherwise defined and described, the terms used in the embodiments of the present invention (including technical and scientific terms may be construed the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs, and the terms such as those defined in commonly used dictionaries may be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art. Further, the terms used in the embodiments of the present invention are for describing the embodiments and are not intended to limit the present invention.

In this specification, the singular forms may also include the plural forms unless specifically stated in the phrase, and may include at least one of all combinations that may be combined in A, B, and C when described in "at least one (or more) of A (and), B, and C". Further, in describing the elements of the embodiments of the present invention, the terms such as first, second, A, B, (A, and (b) may be used.

These terms are only used to distinguish the elements from other elements, and the terms are not limited to the essence, order, or order of the elements. In addition, when an element is described as being "connected", "coupled", or "connected" to another element, it may include not only when the element is directly "connected" to, "coupled" to, or "connected" to other elements, but also when the element is "connected", "coupled", or "connected" by another element between the element and other elements.

In addition, when described as being formed or disposed "on (over)" or "under (below)" of each element, the "on (over)" or "under (below)" may include not only when two elements are directly connected to each other, but also when one or more other elements are formed or disposed between two elements. Further, when expressed as "on (over)" or "under (below)", it may include not only the upper direction but also the lower direction based on one element.

An optical axis direction used below is defined as an optical axis direction of a camera actuator and a lens coupled to a camera module, and a vertical direction may be defined as a direction perpendicular to the optical axis.

"Auto focus function" used below is defined as a function for automatically adjusting a focus on a subject by adjusting a distance from an image sensor and moving a lens in the optical axis direction according to the distance of the subject so that a clear image of the subject may be obtained on the image sensor.

Meanwhile, "auto focus" may correspond to "AF (Auto Focus)". In addition, Closed-loop auto focus (CLAF) control may be defined as real-time feedback control of the lens position by sensing the distance between the image sensor and the lens to improve focus adjustment accuracy.

In addition, before a description of an embodiment of the present invention, a first direction may mean a x-axis direction shown in drawings, and a second direction may be a different direction from the first direction. For example, the second direction may mean a y-axis direction shown in the drawing in a direction perpendicular to the first direction. Also, a third direction may be different from the first and second directions. For example, the third direction may mean a z-axis direction shown in the drawing in a direction perpendicular to the first and second directions. Here, the third direction may mean an optical axis direction.

Hereinafter, a structure in a comparative example and problems thereof will be described before describing embodiments of the present application.

FIG. **1** is a view for explaining a warpage phenomenon of a camera module of a comparative example.

Referring to FIG. **1**, the camera module of a comparative example has a structure including a reinforcing plate **10**, an adhesive member **20** and an image sensor **30**. The image sensor **30** is a sensor die constituting a sensor chip, and is generally a silicon (Si) die.

In this case, the reinforcing plate **10**, the adhesive member **20** and the image sensor **30** (specifically, the silicon die) have different coefficients of thermal expansion (CTE). Here, the coefficient of thermal expansion means an amount of change in 'unit*length' caused by the change in 'unit * temperature'.

In the camera module of the comparative example as described above, a thermal curing process is performed in a state in which the adhesive member **20** is disposed on the reinforcing plate **10** and the image sensor **30** is disposed on the adhesive member **20**. In addition, the image sensor **30** is attached to the reinforcing plate **10** by the thermal curing process.

In this case, as in a top view of FIG. **1**, it can be seen that warpage does not occur when the reinforcing plate **10**, the adhesive member **20**, and the image sensor **30** are sequentially stacked before heating for the thermal curing process. For example, the flatness of the reinforcing plate **10**, the adhesive member **20**, and the image sensor **30** is maintained before the heat is applied.

And, as in a middle view of FIG. **1**, when heat is applied to proceed with the thermal curing, the reinforcing plate **10**, both ends of each of the adhesive member **20**, and the image sensor **30** are expand in a longitudinal direction away from each other.

And, as in a bottom view of FIG. **1**, when the thermal curing process is terminated and the cooling process proceeds (after cool down), each of the expanded reinforcing plate **10**, the adhesive member **20** and the image sensor **30** is contracted to a state before expansion. That is, when heat is applied, each of the reinforcing plate **10**, the adhesive member **20**, and the image sensor **30** is in an expansion state based on a coefficient of thermal expansion.

In this case, the reinforcing plate **10**, the adhesive member **20** and the image sensor **30** have different coefficients of thermal expansion. The coefficient of thermal expansion of each configuration is shown in Table 1 below.

TABLE 1

Material	CTE (((10−6 m/(m ° C.))
Silicon (image sensor die)	3~5
Epoxy (adhesive member)	45~65
Copper Alloys (reinforcing plate)	17.6

As described above, the reinforcing plate **10** has a coefficient of thermal expansion of about 17.6 (10-6 m/(m° C.), the adhesive member **20** has a coefficient of thermal expansion in the range of 45 to 65 (10-6 m/(m° C.), and the image sensor **30** has a coefficient of thermal expansion in a range of 3 to 5 (10-6 m/(m° C.). That is, the adhesive member **20** disposed between the reinforcing plate **10** and the image sensor **30** has a highest coefficient of thermal expansion, and the image sensor **30** has a lowest coefficient of thermal expansion. Accordingly, as described above, the reinforcing plate **10**, the adhesive member **20**, and the image sensor **30** have different coefficients of thermal expansion, and accordingly, it expands and contracts with different expansion rates and contraction rates in the thermal curing process. Accord-

ingly, the reinforcing plate **10**, the adhesive member **20**, and the image sensor **30** are warped in a '∩' shape due to the difference in expansion rate and contraction rate as described above.

In addition, when the warpage phenomenon of the image sensor occurs, there is a problem in that the resolution performance of the camera device is deteriorated, and thus the yield of the camera device is decreased.

Accordingly, the embodiment minimizes the warpage that occurs due to the difference in the coefficient of thermal expansion between the reinforcing plate **10**, the image sensor **30** and the adhesive member **20**, and accordingly, it is possible to improve the performance of the camera device.

FIG. **2** is an exploded perspective view of a camera module according to an embodiment, FIG. **3** is a cross-sectional view of the camera module of FIG. **1** according to an embodiment, FIG. **4** is an enlarged view of a dotted line portion of FIG. **3**, and FIG. **5** is an enlarged view of a bump part according to an embodiment.

Referring to FIGS. **2** to **5**, the camera module **200** may include a lens or lens barrel **400**, a lens driving device **100**, a filter **610**, a holder **600**, a circuit board **800**, a reinforcing plate **900** and an image sensor **810**. Here, "camera module" may be expressed by replacing "capturing device" or "photographer", and the holder **600** may be expressed by replacing "sensor base".

In addition, the camera module **200** may further include a blocking member **1500** disposed on the filter **610**.

In addition, the camera module **300** may further include a third adhesive member **612**.

In addition, the camera module **300** may further include a motion sensor **820**, a control unit **830**, and a connector **840**.

A lens or a lens barrel **400** may be mounted on a bobbin **110** of the lens driving device **100**.

The lens driving device **100** may drive a lens or a lens barrel **400**

The camera module **200** may be any one of a camera module for Auto Focus (AF) and a camera module for Optical Image Stabilizer (OIS). A camera module for AF refers to a thing capable of performing only an autofocus function, and an OIS camera module refers to a thing capable of performing an autofocus function and an OIS (Optical Image Stabilizer) function.

For example, the lens driving device **100** may be a lens driving device for AF or a lens driving device for OIS, where "for AF" and "for OIS" mean a camera module for AF and a camera module for OIS may be the same as described above.

For example, the lens driving device **100** of the camera module **200** may be a lens driving device for OIS.

The lens driving device **100** may include a housing **140**, a bobbin **110** disposed in the housing **140** and for mounting a lens or lens barrel **400**, a first coil **120** disposed on the bobbin **110**, a magnet **130** disposed in the housing **140** and facing the first coil **120**, at least one upper elastic member (not shown) coupled to an upper portion of the bobbin **110** and an upper portion of the housing **140**, at least one lower elastic member (not shown) coupled to a lower portion of the bobbin **110** and a lower portion of the housing **140**, a second coil **230** disposed under the bobbin **110** (or/and housing **140**), a circuit board **250** disposed under the second coil **230**; and a base **210** disposed under the circuit board **250**.

In addition, the lens driving device **100** may be coupled to the base **210**. The lens driving device **100** may include a cover member **300** accommodating components of the lens driving device **100** including the base **210**.

In addition, the lens driving device **100** may include a support member (not shown) that electrically connects the circuit board **250** and the upper elastic member (not shown) and supports the housing **140** with respect to the base **210**.

Each of the first coil **120** and the second coil **230** may be electrically connected to the circuit board **250**. Each of the first coil **120** and the second coil **230** may receive a driving signal (driving current) from the circuit board **250**.

*For example, the upper elastic member (not shown) may include a plurality of upper springs. In addition, a support member (not shown) may be connected to a plurality of upper springs of the upper elastic member. In addition, each of the first coil **120** and the second coil **230** may be electrically connected to the circuit board **250** through the support member. In addition, the first coil **120** and the second coil **230** may receive a driving signal (driving current) from the circuit board **250**.

The first coil **120** may interact with the magnet **130** to generate a first electromagnetic force. In addition, the bobbin **110** and the lens or lens barrel **400** coupled thereto may be moved in the optical axis direction by the generated first electromagnetic force. Accordingly, in the embodiment, AF driving may be implemented as the displacement of the bobbin **110** in the optical axis direction is controlled.

In addition, the second coil **230** may interact with the magnet **130** to generate a second electromagnetic force. In addition, the housing **140** may be moved in a direction perpendicular to the optical axis by the generated second electromagnetic force. Accordingly, in an embodiment, image stabilization or OIS driving may be implemented as the housing is moved in a direction perpendicular to the optical axis.

In addition, the lens driving device **100** of the camera module **200** may further include a sensing magnet (not shown) disposed on the bobbin **110** and an AF position sensor (eg, a hall sensor, not shown) disposed on the housing **140** for AF feedback driving.

The lens driving device **100** may include a position sensor substrate (not shown) on which an AF position sensor is disposed or mounted and coupled to a housing or/and a base.

In another embodiment, the AF position sensor may be disposed on the bobbin, and the sensing magnet may be disposed on the housing. In addition, the lens driving device **100** may include a balancing magnet disposed on the bobbin **110** to correspond to the sensing magnet.

The AF position sensor may output an output signal according to a result of detecting the strength of the magnetic field of the sensing magnet according to a movement of the bobbin **100**. In this case, the AF position sensor may be electrically connected to the circuit board **250** through the upper elastic member (or lower elastic member) and/or the supporting member. The circuit board **250** may provide a driving signal to the AF position sensor. In addition, an output of the AF position sensor may be transmitted to the circuit board **250**.

In another embodiment, the lens driving device **100** may be a lens driving device for AF, and the AF lens driving device may include a housing, a bobbin disposed inside the housing, a coil disposed on the bobbin, a magnet disposed on the housing, at least one elastic member coupled to the bobbin and the housing, and a base disposed under the bobbin (or/and the housing).

For example, the elastic member may include the above-described upper elastic member and the lower elastic member.

A driving signal (eg, a driving current) may be provided to the coil, and the bobbin may be moved in the optical axis

direction by electromagnetic force due to the interaction between the coil and the magnet.

In another embodiment, the coil may be disposed on the housing, and the magnet may be disposed on the bobbin.

In addition, the lens driving device for AF for AF feedback driving may further include a sensing magnet disposed on the bobbin, an AF position sensor (eg, a hall sensor) disposed on the housing, a circuit board disposed or mounted on the housing and/or the base, and a circuit board on which the AF position sensor is disposed and disposed or mounted to the housing and/or base. In another embodiment, the AF position sensor may be disposed on the bobbin, and the sensing magnet may be disposed on the housing.

The camera module according to another embodiment may include a housing coupled to a lens or a lens barrel **400** instead of the lens driving device **100** of FIG. **2** and fixing the lens or the lens barrel **400**. The housing may be coupled or attached to an upper surface of a holder **600**. The housing attached or fixed to the holder **600** may not be moved, and the position of the housing may be fixed while being attached to the holder **600**.

The circuit board may be electrically connected to the coil and the AF position sensor, a driving signal may be provided to each of the coil and the AF position sensor through the circuit board, and the output of the AF position sensor may be transmitted to the circuit board.

The holder **600** may be disposed under the base **210** of the lens driving device **100**.

The filter **610** is mounted on the holder **600**. To this end, the holder **600** may include a seating part **500** on which the filter **610** is seated.

A third adhesive member **612** may couple or attach the base **210** of the lens driving device **100** to the holder **600**. For example, a third adhesive member **612** may be disposed between a lower surface of the base **210** and an upper surface of the holder **600**, and may adhere them to each other.

The third adhesive member **612** may serve to inhibit foreign substances from being introduced into the lens driving device **100** in addition to the above-described adhesive role. For example, the third adhesive member **612** may be an epoxy, a thermosetting adhesive, or an ultraviolet curable adhesive.

The filter **610** may be disposed in the seating part **500** of the holder **600**.

The seating part **500** of the holder **600** may include a protrusion (not shown) protruding from an upper surface of the holder **600**, but is not limited thereto. In another embodiment, the seating part may be in the form of a recess, a cavity, or a hole recessed from the upper surface of the holder **600**.

The protrusion of the seating part **500** may serve to inhibit a lower end of the lens or the lens barrel **400** from contacting or colliding with the filter **610** (or/and the blocking member **1500**).

The protrusion of the seating part **500** may be formed to protrude along the side surface of the filter **610** in the optical axis direction. For example, the protrusion may be disposed around the side surface of the filter **610** to surround the side surface of the filter **610**.

In addition, an inner surface of the protrusion of the seating part **500** may be provided to face the side surface of the filter **610**, and they may be spaced apart from each other. Accordingly, the embodiment may secure a processing tolerance for easily mounting the filter **610** inside the seating part **500** of the holder **600**.

In addition, an upper surface of the protrusion of the seating part **500** may be located higher than the upper surface of the filter **610** in the optical axis direction. This is to inhibit the lens or the lower end of the lens barrel **400** from directly colliding with the filter **610** when the lens or the lens barrel **400** is mounted on the lens driving device **100** and moves in the optical axis direction or moves in the direction toward the filter **610** by an external impact.

The shape of the protrusion of the seating part **500** viewed from the upper side may match a shape of the filter **610**, but is not limited thereto. In another embodiment, the shape of the protrusion of the seating part **500** may be similar to or different from the shape of the filter **610**.

The holder **600** may include an opening **501** formed at a portion where the filter **610** is mounted or disposed so that light passing through the filter **610** may be incident on the image sensor **810**.

For example, the opening **501** may pass through the holder **600** in the optical axis direction, and may be expressed by replacing "through hole".

For example, the opening **501** may pass through a center of the holder **600** and may be provided in the seating part **500**, and an area of the opening **501** may be smaller than an area of the filter **610**.

The holder **600** is disposed on the circuit board **800**, and may accommodate the filter **610** therein. The holder **600** may support the lens driving device **100** positioned on an upper side. The lower surface of the base **210** of the lens driving device **100** may be disposed on an upper surface of the holder **600**.

For example, the lower surface of the base **210** of the lens driving device **100** may be in contact with the upper surface of the holder **600** and may be supported by the upper surface of the holder **600**.

For example, the filter **610** may be disposed in the seating portion **500** of the holder **600**.

The filter **610** may serve to block light of a specific frequency band in light passing through the lens barrel **400** from entering the image sensor **810**.

For example, the filter **610** may be an infrared cut filter, but is not limited thereto. For example, the filter **610** may be disposed to be parallel to an x-y plane perpendicular to the optical axis OA.

The filter **610** may be attached to the seating part **500** of the holder **600** by an adhesive member (not shown) such as UV epoxy.

The circuit board **800** may be disposed under the holder **600**, and the holder **600** may be disposed on the upper surface of the circuit board **800**.

The holder **600** may be attached to or fixed to the upper surface of the circuit board **800** by an adhesive member such as an epoxy, a thermosetting adhesive, or an ultraviolet curable adhesive. In this case, the adhesive member may be disposed between the lower surface of the holder **600** and the upper surface of the circuit board **800**.

The circuit board **800** may have a cavity **801** corresponding to the opening **501** of the holder **600**. The cavity **801** of the circuit board **800** may be in the form of a through hole passing through the circuit board **800** in the optical axis direction.

An image sensor **810** may be disposed in the cavity **801** of the circuit board **800**. For example, at least a portion of the image sensor **810** may be positioned in the cavity **801** of the circuit board **800**.

The reinforcing plate **900** is disposed under the circuit board **800**. For example, the reinforcing plate **900** may be

disposed on a lower surface of the circuit board **800** to cover the cavity **801** at a lower portion of the circuit board **800**.

In this case, the reinforcing plate **900** may include a bump part **910**. Specifically, the bump part **910** may be disposed on the upper surface of the reinforcing plate **900**. In this case, the bump part **910** may overlap the cavity **801** of the circuit board **800** in the optical axis direction. For example, the upper surface of the reinforcing plate **900** may include a contact region contacting the circuit board **800** and an exposed region exposed by the cavity **801**. In addition, the bump part **910** may be disposed on an exposed region of the reinforcing plate **900**. Accordingly, the bump part **910** may be exposed through the cavity **801** of the circuit board **800** in a state where the circuit board **800** is disposed on the reinforcing plate **900**.

The bump part **910** may be attached to the reinforcing plate **900** through a thermal compression method or an ultrasonic compression method. Specifically, the bump part **910** may be a wire bonded to an upper surface of the reinforcing plate **900**. For example, the bump part **910** may be formed by bonding a metal wire to the upper surface of the reinforcing plate **900**.

In this way, the embodiment forms a bump part **910** through bonding of a metal wire on the reinforcing plate **900**. In addition, in the embodiment, a process of attaching or mounting the image sensor **810** is performed in a state where the image sensor **810** is positioned on the formed bump part **910**.

In this case, in the process of attaching or mounting the image sensor **810**, a specific region on the lower surface of the image sensor **810** may be supported by the bump part **910**. Accordingly, in the embodiment, it is possible to solve a warpage problem in which an edge region of the image sensor **810** is bent downward compared to a center region. Accordingly, in the embodiment, it is possible to improve operation reliability by minimizing the occurrence of warpage of the image sensor **810**. For example, as described with reference to FIG. **1**, in the image sensor **810**, smile warpage such as '∩' in which the edge region is bent downward with respect to the center region occurs. In this case, the edge region of the image sensor **810** in the embodiment is supported by the bump part **910** disposed on the exposed region of the reinforcing plate **900**. Accordingly, in the embodiment, it is possible to solve the problem that the edge region of the image sensor **810** is bent downward.

The bump part **910** may protrude from the upper surface of the reinforcing plate **900** in the optical axis direction. In addition, the image sensor **810** may be exposed through the cavity **801** of the circuit board **800** while being supported by the bump part **910**.

Meanwhile, the image sensor **810** supported by the bump part **910** may be electrically connected to the circuit board **800** through a connection wire **21**. For example, the connection wire **21** may connect the terminal **813** of the image sensor **810** and the terminal **1830** of the circuit board **800** to each other.

That is, the lower surface of the image sensor **810** in the embodiment contacts the bump part **910**. In addition, the terminal **813** provided on the upper surface of the image sensor **810** is electrically connected to the circuit board **800** through the connection wire **21**.

In this case, the bump part **910** and the connection wire **21** may be formed using a metal wire made of the same material. Alternatively, the bump part **910** and the connection wire **21** may be formed using wires made of different metals. That is, the bump part **910** serves to support the image sensor **810**, not to transmit electrical signals. Accordingly, the bump part **910** may include a metal material that can be attached on the reinforcing plate **900** through bonding regardless of signal transmission performance. For example, the bump part **910** may be formed using a metal wire of at least one of gold (Au), copper (Cu), aluminum (Al), and silver (Ag). Meanwhile, the connection wire **21** serves as a wire electrically connecting the circuit board **800** and the image sensor **810**. Accordingly, the connection wire **21** may include a metal wire capable of signal transmission and having optimal signal transmission performance. However, in the embodiment, for convenience in the manufacturing process of the camera module, the bump part **910** and the connection wire **21** are respectively formed using the metal wire made of the same material. Preferably, the bump part **910** and the connection wire **21** may be formed of a metal wire containing gold (Au).

The reinforcing plate **900** is a plate-like member having a predetermined thickness and hardness, and can stably support the image sensor **810** and inhibit damage to the image sensor due to external impact or contact.

In addition, the reinforcing plate **900** may improve a heat dissipation effect of dissipating heat generated from the image sensor **810** to the outside. To this end, the reinforcing plate **900** may be formed of a metal material having high thermal conductivity. For example, the reinforcing plate **900** may include SUS or aluminum, but is not limited thereto. For example, the reinforcing plate **900** in another embodiment may be formed of glass epoxy, plastic, or synthetic resin.

In addition, the reinforcing plate **900** may serve as a ground for protecting the camera module from electrostatic discharge protection (ESD) by being electrically connected to a ground terminal (not shown) of the circuit board **800**. To this end, the circuit board **800** includes a ground terminal (not shown), and the ground terminal (not shown) may be exposed to a lower surface of the circuit board **800**. In addition, the reinforcing plate **900** may be electrically connected to the exposed ground terminal (not shown) of the circuit board **800**.

The reinforcing plate **900** may include a surface treatment layer (not shown) on an upper surface. For example, the reinforcing plate **900** may include a surface treatment layer containing nickel (Ni) on the surface. The surface treatment layer may be formed on an entire region of the upper surface of the reinforcing plate **900**. Alternatively, the surface treatment layer may be formed on the exposed region of the upper surface of the reinforcing plate **900**. Alternatively, the surface treatment layer may be selectively formed on a region where the bump part **910** is to be disposed among the exposed region of the reinforcing plate **900**. The surface treatment layer may improve adhesion between the bump part **910** and the reinforcing plate **900**.

That is, the bump part **910** may be formed by bonding a metal wire on the reinforcing plate **900**. In this case, as described above, the metal wire constituting the bump part **910** may include gold (Au). And, as described above, the reinforcing plate **900** may include SUS or aluminum. In this case, when the metal wire containing gold (Au) is directly bonded to the reinforcing plate **900**, bonding properties may be deteriorated. For example, when the bump part **910** is directly formed on the reinforcing plate **900**, bonding strength between the reinforcing plate **900** and the bump part **910** may decrease. To this end, in the embodiment, the surface treatment layer is formed on the upper surface of the reinforcing plate **900**. The surface treatment layer of the reinforcing plate **900** may include a metal material having high bonding properties with the metal wire. For example,

the surface treatment layer may include a nickel metal layer containing nickel. For example, the surface treatment layer may include a first surface treatment layer containing nickel (Ni) disposed on the upper surface of the reinforcing plate **900** and a second surface treatment layer containing palladium (Pd) disposed on the first surface treatment layer. The surface treatment layer of the reinforcing plate **900** may include a metal capable of improving bonding properties with the bump part **910** while inhibiting oxidation of an exposed region of the reinforcing plate **900** exposed through the cavity **801** of the circuit board **800**.

The image sensor **810** may be a portion on which the light passing through the filter **610** is incident to form an image included in the light.

The circuit board **800** may be provided with various circuits, elements, control units, etc. in order to convert an image formed on the image sensor **810** into an electrical signal and transmit it to an external device. A circuit pattern electrically connected to an image sensor and various devices may be formed on the circuit board **800**.

The holder **600** may be represented by replacing a first holder, and the circuit board **800** may be represented by replacing a second holder.

The image sensor **810** may receive an image included in light incident through the lens driving device **100** and convert the received image into an electrical signal.

The filter **610** and the image sensor **810** may be spaced apart to face each other in the optical axis OA direction or the first direction.

In addition, the protrusion **500***a* of the holder **600** may be disposed to face the filter **610** in the optical axis direction.

The blocking member **1500** may be disposed on the upper surface of the filter **610**. The blocking member **1500** may be replaced with a "masking unit".

For example, the blocking member **1500** may be disposed on a corner region of the upper surface of the filter **610**, and serve to block at least a portion of light incident toward the corner region of the filter **610** through the lens or lens barrel **400** from passing through the filter **610**. For example, the blocking member **1500** may be coupled or attached to the upper surface of the filter **1610**.

For example, the filter **610** may be formed in a rectangular shape viewed in the optical axis direction, and the blocking member **1500** may be formed symmetrically with respect to the filter **610** along each side of the upper surface of the filter **610**.

In this case, the blocking member **1500** may be formed to have a constant width at each side of the upper surface of the filter **1610**.

The blocking member **1500** may be formed of an opaque material. For example, the blocking member **1500** may be provided in the form of an opaque adhesive material applied to the filter **610** or in the form of a film attached to the filter **610**.

The filter **610** and the image sensor **810** may be disposed to face each other in the optical axis direction, and the blocking member **1500** may at least partially overlap the terminal **1830** and/or the connection wire **21** disposed on the circuit board **800** in the optical axis direction.

The connection wire **21** and the terminal **1830** may be formed of a conductive material, for example, gold (Au), silver (Ag), copper (Cu), a copper alloy, etc., and such a conductive material may have a property of reflecting light. The light passing through the filter **610** may be reflected by the terminal **1830** and the connection wire **21** of the circuit board **800**, and an instantaneous flashing, that is, a flare phenomenon may occur by this reflected light, and such a flare phenomenon may distort an image formed on the image sensor **810** or deteriorate image quality.

The blocking member **1500** is disposed so that at least a portion overlaps with the terminal **1830** and/or the connection wire **21** in the optical axis direction, thereby, it is possible to block the light directed to the terminal **1830** of the circuit board **800**, and/or the connection wire **21** among the light passing through the lens or the lens barrel **400**. Accordingly, the embodiment may inhibit the occurrence of the above-described flare phenomenon through the blocking member **1500**, and may solve problems such as distortion or deterioration of image quality formed on the image sensor **810**.

A motion sensor **820** may be mounted or disposed on the circuit board **800**, and may be electrically connected to the controller **830** through a circuit pattern (not shown) provided on the circuit board **800**.

The motion sensor **820** outputs rotational angular velocity information by the movement of the camera module **200**. The motion sensor **820** may be implemented as a 2-axis or 3-axis gyro sensor or an angular velocity sensor.

A control unit **830** is mounted or disposed on the circuit board **800**.

*The circuit board **800** may be electrically connected to the lens driving device **100**. For example, the circuit board **800** may be electrically connected to the circuit board **250** of the lens driving device **100**.

For example, a driving signal may be provided to each of the first coil **120** and the second coil **230** of the lens driving device **100** through the circuit board **800**, and a drive signal may be provided to the AF position sensor (or OIS position sensor). Also, the output of the AF position sensor (or OIS position sensor) may be transmitted to the circuit board **800**.

The connector **840** is electrically connected to the circuit board **800**, and may include a port for electrically connecting to an external device.

A first adhesive member **1750** may be disposed between the lower surface of the image sensor **810** and the reinforcing plate **900**, and the image sensor **810** may be attached or fixed on the reinforcing plate **10** by the first adhesive member **1750**. For example, the image sensor **810** may be attached or fixed on the exposed region of the reinforcing plate **900** through the first adhesive member **1750** while being supported by the bump part **910**.

In this case, the reinforcing plate **900** may be divided into a plurality of regions. For example, the upper surface of the reinforcing plate **900** may include a first region S1 and a second region S2. The first region S1 may be a region overlapping the image sensor **810** in the optical axis direction OA. The first region S1 may be a region overlapping a portion of the cavity **801** of the circuit board **800** in the optical axis direction OA.

The first region S1 may be a region to which the image sensor **810** is attached. The second region S2 may be a region where the second adhesive member **1700** is disposed. The second region S2 may be a region overlapping the other portions of the circuit board **800** except for a part of the cavity **801** in the optical axis direction OA.

In addition, the bump part **910** may be formed on the first region S1 of the upper surface of the reinforcing plate **900**.

The image sensor **810** may be supported or fixed to the bump part **910**. For example, at least a portion of a lower surface of the image sensor **810** may be in direct contact with the bump part **910**. That is, the first adhesive member **1750** in the embodiment may be selectively formed in a region of the first region S1 in which the bump part **910** is not disposed. Accordingly, at least a first portion of the lower

surface of the image sensor **810** may be in direct contact with the bump part **910**, and at least a second portion of the image sensor **810** may be in direct contact with the first adhesive member **1750**. That is, the second portion of the image sensor **810** may be attached or fixed to the first adhesive member **1750** in a state in which the first portion is supported by the bump part **910**. Accordingly, at least a portion of the image sensor **810** in an embodiment may be in direct contact with the bump part **910** to minimize the warpage of the image sensor **810**. For example, the bump part **910** may inhibit the image sensor **810** attached or fixed to the first adhesive member **1750** from being tilted.

In addition, the embodiment can efficiently transfer heat generated from the image sensor **810** to the outside by allowing at least a portion of the image sensor **810** to directly contact the bump part **910**. For example, the bump part **910** may additionally perform a function of transferring heat generated from the image sensor **810** to the reinforcing plate **900** in addition to supporting the image sensor **810**. Accordingly, the embodiment can solve the warpage of the image sensor **810** by using the bump part **910** and further improve the heat dissipation properties of the image sensor **810**.

Accordingly, an area of the image sensor **810** in the embodiment may be larger than an area of the first adhesive member **1750**. That is, only a portion of the area of the image sensor **810** may contact the first adhesive member **1750**. For example, a first portion of the lower surface of the image sensor **810** may contact the bump part **910**, and a second portion other than the first portion may contact the first adhesive member **1750**.

In this case, the bump part **910** and the first adhesive member **1750** may be spaced apart from each other on the reinforcing plate **900**.

Accordingly, the lower surface of the image sensor **810** may be divided into at least three regions. That is, the lower surface of the image sensor **810** may include a first portion in contact with the bump part **910**, a second portion contacting the first adhesive member **1750**, and a third portion corresponding to a separation region between the first portion and the second portion.

The first adhesive member **1750** may be an epoxy, a thermosetting adhesive, an ultraviolet curable adhesive, an adhesive film, or the like, but is not limited thereto.

In addition, a second adhesive member **1700** may be disposed between the lower surface of the circuit board **800** and the upper surface **900***a* of the second region S2 of the reinforcing plate **900**, and the circuit board **800** may be attached to or fixed to the reinforcing plate **900** by the second adhesive member **1700**. For example, the second adhesive member **1700** may be an epoxy, a thermosetting adhesive, an ultraviolet curable adhesive, or an adhesive film, but is not limited thereto.

On the other hand, a ratio of a first height H1 from the upper surface **900***a* of the second region S2 of the reinforcing plate **900** to the uppermost end of the bump part **910** and a second height H2 from the lower surface **900***b* of the reinforcing plate **900** to the upper surface **900***a* of the second region S2 of the reinforcing plate **900** (H1:H2) may be 1:0.67 to 1:2.1.

In this case, when a value (H2/H1) obtained by dividing the second height by the first height is less than 0.67, the reinforcing plate **900** is easily bent or deformed to a level that does not support the circuit board **800**.

In addition, when the value (H2/H1) obtained by dividing the second height by the first height exceeds 2.1, the protruding height of the wire part is insignificant and the flatness of the reinforcing plate **900** cannot be improved. In addition, when the value obtained by dividing the second height by the first height (H2/H1) exceeds 2.1, an effect of reducing a step in the optical axis direction between the upper surface of the image sensor **810** and the upper surface of the circuit board **800** is reduced, and thus reliability of wire bonding between the two cannot be secured. For example, H1 corresponding to the height of the bump part **910** may be 46 μm to 62 μm. Preferably, H1 corresponding to the height of the bump part **910** may be 48 μm to 60 μm. More preferably, H1 corresponding to the height of the bump part **910** may be 49 μm to 59 μm. The height of the bump part **910** will be described in more detail below.

Meanwhile, a height from a lower surface **900***b* of the reinforcing plate **900** to an uppermost end of the bump part **910** may be lower than a height of the upper surface of the circuit board **800** disposed on the reinforcing plate **900**. For example, the reinforcing plate **900** may include a first region S1 and a second region S2, and the first region S1 may be a region to which the image sensor **810** is attached, and the second region S2 may be a region to which the circuit board **800** is attached.

In addition, the first region S1 may include a first-first region S1-1 in which the first adhesive member **1750** is disposed, and a first-second region S1-2 in which the bump part **910** is disposed. In addition, the first-first region S1-1 may have the same height as the second region S2.

The first region S1 of the reinforcing plate **900** may include a bump part **910** protruding in the optical axis direction with respect to the first-first region S1-1, and the image sensor **810** may be disposed on the upper surface of the bump part **910**.

For example, the first-second region S1-2 of the first region S1 of the reinforcing plate **900** may include the bump part **910** positioned higher than the first-first region S1-1 and the second region S2 of the reinforcing plate **900**.

Since the entire region of the reinforcement plate **900** has a constant thickness, the embodiment may not be affected by the overall height of the camera module. In addition, since the image sensor **810** is disposed in direct contact with the bump part **910**, a height difference between the upper surface of the circuit board **800** and the upper surface of the image sensor **810** is reduced, so that, a length of the connection wire **21** that electrically connects the circuit board **800** and the image sensor **810** is shortened, and thereby, wire bonding reliability for the connection wire **21** may be improved.

A side surface of the image sensor **810** may be spaced apart from an inner wall of the cavity **801** of the circuit board **800** by a first separation distance D1. For example, the first separation distance D1 may be 100 μm to 250 μm. When the first separation distance D1 is less than 100 μm, an attachment tolerance for attaching the circuit board **800** to the reinforcing plate **900** may be reduced. In addition, when the attachment tolerance is reduced, misalignment occurs between the cavity **801** of the circuit board **800** and the bump part **910**, and the circuit board **800** may be damaged due to a collision between the circuit board **800** and the bump part **910**.

In addition, when the first separation distance D1 exceeds 250 μm, a length of the connection wire **21** may increase as the separation distance between the image sensor **810** and the inner wall of the cavity **801** of the circuit board **800** increases. In addition, when the length of the connection wire **21** increases, the bonding properties of the connection wire **21** may be deteriorated, and Furthermore, reliability may be deteriorated due to the inclusion of noise in the signal transmitted through the connection wire **21**.

Meanwhile, the bump part **910** in the embodiment may include a plurality of bump parts spaced apart from each other with the first-first region S1-1 interposed in the first region S1 of the reinforcing plate **900**. For example, the bump part **910** may include a first bump part **911**, a second bump part **912**, a third bump part **913**, and a fourth bump part **914**.

That is, the first region S1 of the reinforcing plate **900** may include a first-second region S1-2 in which the first bump part **911**, the second bump part **912**, the third bump part **913**, and the fourth bump part **914** are disposed, and the first-first region S1-1 other than the first-second region S1-2. In addition, the first adhesive member **1750** may be selectively disposed in the first-first region S1-1.

Accordingly, the embodiment may support different regions of the lower surface of the image sensor **810** through the first bump part **911**, the second bump part **912**, the third bump part **913**, and the fourth bump part **914**. Accordingly, the embodiment may more stably support the image sensor **810** and thus minimize the warpage phenomenon. In addition, the embodiment can branch and provide heat generated from the image sensor **810** in different paths through a plurality of mutually separated bump parts, thereby improving heat dissipation performance.

In this case, positions where the first to fourth bump parts **911**, **912**, **913**, and **914** are disposed may correspond to corner regions of the lower surface of the image sensor **810**. For example, the image sensor **810** may have a square shape. In addition, the lower surface of the image sensor **810** may include four corner regions. Accordingly, the first to fourth bump parts **911**, **912**, **913**, and **914** may respectively correspond to the four corner regions of the lower surface of the image sensor **810**.

Hereinafter, the bump part **910** will be described in detail.

The bump part **910** in the embodiment may have a multi-layer structure. For example, each of the first to fourth bump parts **911**, **912**, **913**, and **914** may have a plurality of layer structures. For example, each of the first to fourth bump parts **911**, **912**, **913**, and **914** may have a two-layer structure. However, the embodiment is not limited thereto, and the number of layers of the bump part **910** may increase. However, the embodiment allows the bump part **910** to be formed in two layers so that the image sensor **810** can be stably supported by the bump part **910** while securing the height that the bump part **910** should have.

To this end, the bump part **910** may include a first bump **910***a* and a second bump **910***b*.

The first bump **910***a* may be disposed on an upper surface of the reinforcing plate **900**. More preferably, the first bump **910***a* may be disposed on a surface treatment layer formed on an upper surface of the reinforcing plate **900**.

A vertical cross-sectional shape of the first bump **910***a* may have an ellipse shape. However, the embodiment is not limited thereto, and the vertical cross-sectional shape of the first bump **910***a* may have a square shape.

A second bump **910***b* may be disposed on the first bump **910***a*. The second bump **910***b* may have a different thickness from a thickness of the first bump **910***a*. Preferably, the thickness of the second bump **910***b* may be greater than the thickness of the first bump **910***a*. That is, the second bump **910***b* is formed of the same metal wire as the first bump **910***a*. In this case, in the embodiment, the first bump **910***a* is formed on the reinforcing plate **900** by primary bonding, and the second bump **910***b* is formed on the first bump **910***a* by secondary bonding. In this case, in the process of forming the second bump **910***b*, the first bump **910***a* may be pressed by the second bump **910***b*, and accordingly, the first bump **910***a* may be formed to have a thickness thinner than that of the second bump **910***b*.

In this case, the thickness of the first bump **910***a* and the thickness of the second bump **910***b* may be expressed as the height of the first bump **910***a* and the height of the second bump **910***b*, respectively. For example, a height of the first bump **910***a* may mean a straight line distance from the lower surface of the first bump **910***a* to the upper surface. In addition, a height of the second bump **910***b* may mean a straight line distance from the lower surface to the upper surface of the second bump **910***b*.

Meanwhile, the first bump **910***a* may be formed by pressing a metal wire placed on the upper surface of the reinforcing plate **900** and bonding the pressed metal wire. Specifically, the first bump **910***a* may be a lumped portion on the reinforcing plate **900** as bonding proceeds while the metal wire is pressed. In addition, the second bump **910***b* may be formed by additionally bonding the metal wire on the first bump **910***a*.

In this case, before describing the bump part **910**, the metal wire forming the first bump **910***a* and the second bump **910***b* may be gold (Au). In this case, the metal wire may have a certain diameter. For example, the metal wire may have a diameter of 22 μm to 28 μm. Preferably, the metal wire may have a diameter of 23 μm to 27 μm. More preferably, the metal wire may have a diameter of 24 μm to 26 μm. For example, the metal wire may have a diameter of 0.9 mil.

Here, the width and thickness of the bump part **910** may be determined according to the diameter of the metal wire. In addition, the diameter of the metal wire may have an optimal thickness and width of the bump part **910** in the embodiment.

For example, when the diameter of the metal wire is out of the range of 22 m to 28 μm, reliability of the bump part **910** may deteriorate. For example, when the diameter of the metal wire is smaller than 22 μm, it may be difficult to form the bump part **910** with a height or thickness corresponding to H1. For example, when the diameter of the metal wire is smaller than 22 μm, the number of layers of the bump part **910** may increase to satisfy H1 that the bump part **910** should have. In addition, when the number of layers of the bump part increases, a manufacturing process accordingly may become complicated. In addition, when the number of layers of the bump part increases, it may be difficult to align the bump parts of each layer accordingly. In addition, when the number of layers of the bump part increases, a difference in height between the first to fourth bump parts **911**, **912**, **913**, and **914** may increase, and thus mounting reliability of the image sensor **810** may deteriorate.

In this case, when the height difference occurs between the first to fourth bump parts **911**, **912**, **913**, and **914**, the image sensor disposed on the first to fourth bump parts **911**, **912**, **913**, and **914** **810** also has an inclination corresponding to the height difference. In this case, in the camera module according to the embodiment, the lens barrel **400** may be inclined to correspond to the inclination angle of the image sensor **810** through active alignment. However, when the number of layers of the bump part **910** increases, the height difference between the first to fourth bump parts **911**, **912**, **913**, and **914** increases accordingly, and accordingly, there may be difficulties in the active alignment process. Furthermore, when the height difference between the first to fourth bump parts **911**, **912**, **913**, and **914** increases, a problem may occur in that a specific bump part does not come into contact

with the image sensor **810**, and thus the normal function of the bump part **910** may not be performed.

In addition, when the diameter of the metal wire is greater than 28 μm, the width of the bump part **910** may increase. For example, when the diameter of the metal wire is greater than 28 μm, the width of the bump part **910** may increase to correspond to H1 that the bump part **910** should have. In addition, when the width of the bump part **910** increases, an area occupied by the bump part **910** in the first region S1 may increase, so that an area where the first adhesive member **1750** is disposed may decrease. In addition, the adhesive strength of the image sensor **810** by the first adhesive member **1750** decreases as the area where the first adhesive member **1750** is disposed decreases to a certain level or more, and this can cause reliability problems. In addition, when the diameter of the metal wire is greater than 28 μm, the width of the bump part **910** may increase, and accordingly, the size of the cavity **801** of the circuit board **800** to secure a space in which the bump part **910** is disposed may increase or the first separation distance D1 may increase.

Accordingly, the embodiment allows to form the bump part **910** including the first bump **910***a* and the second bump **910***b* of the two-layer structure using a metal wire having a diameter in the range of 22 μm to 28 μm.

The first bump **910***a* may have a first-first height H1-1. The first-first height H1-1 may be 11 μm to 26 μm. Preferably, the first-first height H1-1 may be 12 μm to 25 μm. More preferably, the first-first height H1-1 may be 14 μm to 23 μm. When the first-first height H1-1 of the first bump **910***a* is smaller than 11 μm, the height of the second bump **910***b* may correspondingly increase. In this case, the height of the second bump **910***b* is limited, and accordingly, the bump part **910** must be formed in three or more layers to satisfy the first height H1 that the bump part **910** should have. In addition, the first-first height H1-1 of the first bump **910***a* may be determined by the diameter of the metal wire. In this case, as described above, the diameter of the metal wire is 22 μm to 28 am, and accordingly, it may be difficult to form the first bump **910***a* with a height lower than 11 μm using the metal wire. In addition, when the first-first height H1-1 of the first bump **910***a* is greater than 25 μm, the first width D1 of the first bump **910***a* may increase corresponding to the increase in the height of the first bump **910***a*. In addition, when the first width D1 of the first bump **910***a* increases, there are problems in that an arrangement area of the first adhesive member **1750** decreases, the size of the cavity **801** increases, or the first separation distance increases.

Meanwhile, the first-first height H1-1 of the first bump **910***a* may be determined by the diameter of the metal wire. Preferably, the first-first height H1-1 of the first bump **910***a* may be smaller than the diameter of the metal wire. For example, the first-first height H1-1 of the first bump **910***a* may satisfy 50% to 90% of the diameter of the metal wire. Preferably, the first-first height H1-1 of the first bump **910***a* may be 54% to 85% of the diameter of the metal wire. More preferably, the first-first height H1-1 of the first bump **910***a* may be 60% to 82% of the diameter of the metal wire.

Meanwhile, the first bump **910***a* may have a first width D1. For example, the first width D1 of the first bump **910***a* may be 70 μm to 97 μm. Preferably, the first width D1 of the first bump **910***a* may be 73 μm to 94 μm. More preferably, the first width D1 of the first bump **910***a* may be 75 μm to 92 μm. Here, the first width D1 of the first bump **910***a* may mean the diameter of the first bump **910***a*. For example, a horizontal cross-sectional shape of the first bump **910***a* may be a circular shape, and thus the first width D1 may mean a diameter of a circle of the first bump **910***a*. Meanwhile, a horizontal cross-sectional shape of the first bump **910***a* may be an ellipse. In this case, the first width D1 of the first bump **910***a* may mean a value at a portion having a greatest diameter in the ellipse. In addition, the horizontal cross-sectional shape of the first bump **910***a* may have a shape other than circular.

The second bump **910***b* is disposed on the first bump **910***a*.

In this case, the second bump **910***b* may have a first-second height H1-2 greater than the first-first height H1-1 of the first bump **910***a*. In addition, the second bump **910***b* may have a second width D2 smaller than the first width D1 of the first bump **910***a*.

The second bump **910***b* is disposed on the first bump **910***a*. In this case, in the process of forming the second bump **910***b*, the second bump **910***b* may press the first bump **910***a*. Accordingly, the height of the first bump **910***a* decreases and the width of the first bump **910***a* increases in the process of forming the second bump **910***b*. Accordingly, the height of the first bump **910***a* may be greater than the height of the second bump **910***b*, and the width of the first bump **910***a* may be greater than that of the second bump **910***b*.

The first-second height H1-2 of the second bump **910***b* may be 28 μm to 44 μm.

Preferably, the first-second height H1-2 of the second bump **910***b* may be 30 μm to 42 μm. More preferably, the first-second height H1-2 of the second bump **910***b* may be 31 μm to 41 μm. When the first-second height H1-2 of the second bump **910***b* is smaller than 28 am, an additional layer of bumps must be formed on the second bump **910***b* in order to satisfy the height H1 that the bump part **910** should have. In addition, when the first-second height H1-2 of the second bump **910***b* is greater than 44 μm, the second width D2 of the second bump **910***b* may increase. In addition, when the second width D2 of the second bump **910***b* increases, the first width D1 of the first bump **910***a* must also increase accordingly, and accordingly, there are problems in that an arrangement area of the first adhesive member **1750** decreases, the size of the cavity **801** increases, or the first separation distance increases.

Meanwhile, the first-second height H1-2 of the second bump **910***b* may be determined by the diameter of the metal wire. Preferably, the first-second height H1-2 of the second bump **910***b* may be greater than the diameter of the metal wire. For example, the first-second height H1-2 of the second bump **910***b* may be 115% to 170% of the diameter of the metal wire. Preferably, the first-second height H1-2 of the second bump **910***b* may be 135% to 150% of the diameter of the metal wire. More preferably, the first-second height H1-2 of the second bump **910***b* may be 140% to 1^{46}% of the diameter of the metal wire.

Meanwhile, the second bump **910***b* may have a second width D2. For example, the second width D2 of the second bump **910***b* may be 50 μm to 80 μm. Preferably, the second width D2 of the second bump **910***b* may be 54 μm to 78 μm. More preferably, the second width D2 of the second bump **910***b* may be 57 μm to 73 μm. Here, the second width D2 of the second bump **910***b* may mean the diameter of the second bump **910***b*. For example, a horizontal cross-sectional shape of the second bump **910***b* may be a circular shape, and thus the second width D2 may mean a diameter of a circle of the second bump **910***b*. Meanwhile, the horizontal cross-sectional shape of the second bump **910***b* may be an ellipse. In this case, the second width D2 of the second bump **910***b* may mean a value at a portion having a greatest diameter in the

ellipse. In addition, the horizontal cross-sectional shape of the second bump **910***b* may have a shape other than circular.

The camera module and the optical device including the camera module according to the embodiment include a bump part. The bump part may be formed by bonding a metal wire on a reinforcing plate. In this case, a region overlapping the image sensor in the optical axis direction of the upper surface of the reinforcing plate includes a region where the bump part is disposed and a region where an adhesive member for attaching or fixing the image sensor is disposed. That is, the adhesive member may be selectively disposed on a region of the upper surface of the reinforcing plate where the bump part is not formed. In addition, in the embodiment, at least a portion of the lower surface of the image sensor can be attached or fixed on the reinforcing plate by the adhesive member in a state where it is directly contacted and supported by the bump part. Accordingly, in the embodiment, at least a portion of the image sensor directly contacts and supports the bump part, thereby minimizing the bending of the image sensor and thereby improving the reliability of operation of the camera module.

Furthermore, in the embodiment, at least a portion of the image sensor directly contacts the bump part, and the bump part directly contacts the reinforcing plate, so that heat generated from the image sensor can be efficiently transferred to the outside.

Hereinafter, the structure of the reinforcing plate **900**, the bump part **910**, the first adhesive member **1750**, and the image sensor **810** according to the embodiment and the arrangement relationship thereof will be described in detail.

FIG. **6** is a plan view showing a circuit board, a reinforcing plate, a bump part, and a first adhesive member before an image sensor according to the first embodiment is attached, FIG. **7** is a view illustrating various embodiments of an arrangement shape of a first adhesive member, FIG. **8** is a view illustrating a degree of occurrence of warpage according to an arrangement area of a first adhesive member, FIGS. **9** and **10** are views illustrating an arrangement relationship between a bump part and the image sensor according to a first embodiment.

FIGS. **6** to **10**, the reinforcing plate **900** includes a first region S1 and a second region S2.

In addition, an upper surface of the first region S1 of the reinforcing plate **900** may be exposed through the cavity **801** of the circuit board **800**. The first region S1 may be a region in which the image sensor **810** is disposed in the cavity **801** of the circuit board **800**, and the second region S2 may be a region in which the circuit board **800** is disposed.

Specifically, the first region S1 of the reinforcing plate **900** includes a first-first region S1-1 in which the first adhesive member **1750** is disposed and a first-second region S1-2 in which the bump part **910** is disposed. The first region S1 may correspond to the shape of the image sensor **810**. For example, the first region S1 may have a rectangular shape corresponding to the shape of the image sensor **810**, but is not limited thereto.

A first bump part **911**, a second bump part **912**, a third bump part and a fourth bump part may be formed in the first-second region S1-2. In this case, the first bump part **911**, the second bump part **912**, the third bump part **913**, and the fourth bump part **914** may be spaced apart from each other in the first region S1. For example, the first bump part **911**, the second bump part **912**, the third bump part **913**, and the fourth bump part **914** may be positioned in a region overlapping the corner region of the lower surface of the image sensor **810** in the optical axis direction in the first region S1. Accordingly, the first-second region S1-2 may be a region overlapping the corner region of the lower surface of the image sensor **810** in the optical axis direction.

A first adhesive member **1750** may be disposed in the first-first region S1-1. For example, the first adhesive member **1750** may be disposed at a position spaced apart from the first bump parts while the first bump part **911**, the second bump part **912**, the third bump part **913**, and the fourth bump part **914** are not disposed.

In the embodiment, the image sensor **810** is attached or fixed on the reinforcing plate **900** through the first adhesive member **1750** in a state in which the corner region of the image sensor **840** is supported through the first bump part **911**, the second bump part **912**, the third bump part **913**, and the fourth bump part **914**.

For example, the first adhesive member in the comparative example was formed on the reinforcing plate, and thus the image sensor was attached on the first adhesive member. Specifically, the first adhesive member in the comparative example was applied to the entire region overlapping the image sensor in the optical axis direction.

Alternatively, the first adhesive member **1750** in the embodiment may be formed only on a partial region of the lower surface of the image sensor **810**. Accordingly, an area of a lower surface of the image sensor **810** may be greater than an area of an upper surface of the first adhesive member **1750**. For example, an area of an upper surface of the first adhesive member **1750** may be less than 80% of an area of a lower surface of the image sensor **810**. For example, the area of the upper surface of the first adhesive member **1750** may be less than or equal to 70% of the area of the lower surface of the image sensor **810**. For example, the area of the upper surface of the first adhesive member **1750** may be less than or equal to 60% of the area of the lower surface of the image sensor **810**. For example, the area of the upper surface of the first adhesive member **1750** may be less than or equal to 50% of the area of the lower surface of the image sensor **810**.

Preferably, the area of the upper surface of the first adhesive member **1750** is 50% or less of the area of the lower surface of the image sensor **810**. According to this, the arrangement area of the first adhesive member **1750** in the embodiment is reduced compared to the area of the image sensor **810**, and accordingly, it is possible to minimize the warpage that increases in proportion to the area of the first adhesive member **1750**.

Referring to FIG. **7**, as in (a), (b) and (c), the first adhesive member **1750** may have various shapes and may be applied on the reinforcing plate **900**. However, the first adhesive member **1750** in the embodiment has a snowflake shape as in (c) of FIG. **7**. That is, it was confirmed that a change in the degree of warpage occurs also depending on the application shape of the first adhesive member **1750**, and when the first adhesive member **1750** is applied in the shape as shown in FIG. **7**(*c*), as a result, it was confirmed that the degree of occurrence of warpage was the lowest.

Also, referring to FIG. **8**, when the area of the first adhesive member **1750** is 75% or more of the area of the lower surface of the image sensor **810**, the degree of warpage of the image sensor **810** is 100%, when the area of the first adhesive member **1750** is 50% of the area of the lower surface of the image sensor **810**, it can be confirmed that the degree of warpage of the image sensor **810** is 88%, which is smaller than 100.

In other words, as the area of the first adhesive member **1750** in contact with the image sensor **810** decreases, the influence of the coefficient of thermal expansion is reduced, and thus it can be seen that the degree of warpage is reduced.

Accordingly, the area of the portion in contact with the first adhesive member **1750** compared to the total area of the lower surface of the image sensor **810** in the embodiment is 50% or less, and accordingly, the occurrence of warpage of the image sensor **810** is minimized. However, when the area of the first adhesive member **1750** is reduced to 30% or less, the attachment or fixation force of the image sensor **810** may be reduced. Accordingly, the area of the first adhesive member **1750** is in a range of 30% to 50% of the area of the image sensor **810**.

As described above, only a partial region of the lower surface of the image sensor **810** in the embodiment is in contact with the first adhesive member **1750**, and accordingly, the occurrence of warpage of the image sensor **810** may be minimized, and thus the performance of the image sensor may be improved.

Meanwhile, the first adhesive member **1750** may be formed on the first-first region S1-1 of the first region S1 of the reinforcing plate **900**. For example, the first adhesive member **1750** may be formed in the remaining region of the first region S1 of the reinforcing plate **900** except for the corner region. For example, the first adhesive member **1750** may have various shapes (preferably a snowflake shape) on the first-first region S1-1 of the reinforcing plate **900**.

The bump part **910** may be formed on the first-second region S1-2 of the first region S1 of the reinforcing plate **900**. For example, the bump part **910** may be formed in a corner region of the first region S1 of the reinforcing plate **900**.

The bump part **910** may include a first bump part **911** formed in a first corner region of the first region S1 of the reinforcing plate **900**. The bump part **910** may include a second bump part **912** formed in a second corner region of the first region S1 of the reinforcing plate **900**. The bump part **910** may include a third bump part **913** formed in a third corner region of the first region S1 of the reinforcing plate **900**. The wire part may include a fourth bump part **911** formed in a fourth corner region of the first region S1 of the reinforcing plate **900**.

The plurality of bump part **910** may be spaced apart from the first adhesive member **1750** on the first region S1 of the reinforcing plate **900**. For example, the first adhesive member **1750** may not contact the bump part **910**. Accordingly, heat generated through the image sensor **810** in an embodiment may be radiated to the outside through a plurality of branched paths, and thus heat dissipation performance may be improved.

Meanwhile, the number of the bump part **910** was four in the above description, the embodiment is not limited thereto. For example, the bump part **910** may further include a sub bump part formed between adjacent corner regions among the four corner regions.

The bump part **910** may be spaced apart from in inner wall of the cavity **801** by a predetermined interval within the cavity **801** of the circuit board **800**. For example, the interval of 100 μm to 250 μm may exist between the bump part **910** and the inner wall of the cavity **801** of the circuit board **800**. When the interval is less than 100 μm, an attachment tolerance for attaching the circuit board **800** to the reinforcing plate **900** becomes small, so that misalignment between the cavity **801** of the circuit board **800** and the bump part **910** occurs. Also, the circuit board **800** may be damaged due to collision between the circuit board **800** and the bump part **910**. In addition, when the interval exceeds 250 μm, a separation distance between the image sensor and the circuit board increases, so that the reliability of wire bonding to the connection wire **21** may deteriorate.

The bump part **910** may overlap a specific region of the image sensor **810** in an optical axis direction. Preferably, the second bump **910***b* constituting the bump part **910** may overlap a specific region of the image sensor **810** in an optical axis direction.

For example, the image sensor **810** may include a pixel region **811** including a plurality of pixels for detecting an optical image (image information) incident through a lens, and a passivation region **812** other than the pixel region.

In this case, the bump part **910** may be formed such that at least a portion of the pixel region **810** overlaps in the corner region of the image sensor **810**. For example, the bump part **910** may be formed in a region overlapping the pixel region **811** of the image sensor **810** in the optical axis direction OA in the first region S1 of the reinforcing plate **900**.

Specifically, the pixel region of the image sensor **810** may include an active pixel region **811-1** used to detect actual image information, and a dummy pixel region **811-2** other than the active pixel region **811-1**. The active pixel region **811-1** may be used to generate image information using incident light. The dummy pixel region **811-2** is not used to generate image information, but may have the same structure as the active pixel region **811-1**. That is, the image sensor **810** includes a dummy pixel region **811-2** between the active pixel region **811-1** generating actual image information and the passivation region **812** for protection thereof in order to increase reliability in the generation of image information.

And, the bump part **910** in the embodiment may overlap a corner region of the active pixel region **811-1** of the image sensor in the optical axis direction. That is, the region in which flatness is most important in the image sensor **810** is the active pixel region **811-1**, and the flatness of the active pixel region **811-1** substantially determines the performance and operational reliability of the image sensor **810**. Accordingly, at least a portion of the active pixel region **811-1** in the embodiment may be supported by the bump part **910**.

In addition, the bump part **910** in the embodiment overlaps at least a portion of a corner region of the active pixel region **811-1** in the optical axis direction. Accordingly, a lower surface of the image sensor **810** corresponding to the active pixel region **811-1** in the embodiment may be supported by the bump part **910**, so that it is possible to minimize the occurrence of warpage of the active pixel region **811-1** of the image sensor **810**.

That is, when the bump part **910** overlaps the active pixel region **811-1** in the optical axis direction, the overall flatness of the active pixel region **811-1** may be maintained, and accordingly, it is possible to minimize the occurrence of warpage of the active pixel region **811-1** of the image sensor **810**.

FIG. **11** is a plan view illustrating a circuit board, a reinforcing plate, a bump part, and a first adhesive member before an image sensor is attached according to a second embodiment, and FIG. **12** is a diagram for explaining an arrangement relationship between a bump part and the image sensor according to the second embodiment.

The bump part **910** in the first embodiment has a circular cross section. Unlike this, the bump part in the second embodiment may have an elliptical cross section.

Referring to FIGS. **11** and **12**, the first to fourth bump parts **911***a*, **911***b*, **911***c*, and **911***d* are formed in an elliptical shape, and accordingly, it may be disposed in a direction connecting adjacent corner regions among a plurality of corner regions of the image sensor **810**. In this case, bump

parts adjacent to each other in the first to fourth bump parts **911***a*, **911***b*, **911***c*, and **911***d* may be arranged in different directions.

For example, the first to fourth bump parts **911***a*, **911***b*, **911***c*, and **911***d* have an elliptical shape, and thus may be divided into a major axis direction and a minor axis direction. Further, a major axis of the first bump part **911***a* may be arranged in a length direction on the reinforcing plate **900**. In addition, a major axis of the second bump part **911***b* may be arranged in a width direction on the reinforcing plate **900**. In addition, a major axis of the third bump part **911***c* may be arranged in a length direction on the reinforcing plate **900**. In addition, a major axis of the fourth bump part **911***d* may be arranged in a width direction on the reinforcing plate **900**. As described above, in the embodiment, the major axes of the first to fourth bump parts **911***a*, **911***b*, **911***c*, and **911***d* having an elliptical shape are arranged in different directions on the reinforcing plate **900**. Accordingly, the embodiment may more stably support the image sensor **810** to improve the flatness of the image sensor **810**.

FIG. **13** is a graph illustrating a degree of warpage of an image sensor according to a comparative example, and FIG. **14** is a graph illustrating a degree of warpage of an image sensor including a bump part according to an embodiment.

FIG. **13** illustrates values of the degree of warpage for each position of an image sensor according to a comparative example. For example, a x-axis of the graph of FIG. **13** represents the position of the image sensor, and a y-axis represents the height or degree of warpage at each position.

Referring to FIG. **13**, in the comparative example, it was confirmed that the maximum degree of warpage (Wmax 1) in a center portion and an edge region of the image sensor **810** was 7.74 μm.

* FIG. **14** shows values of the degree of warpage by position of an image sensor in a structure including a bump part according to an embodiment. For example, a x-axis of the graph of FIG. **14** represents the position of the image sensor, and a y-axis represents the height or degree of warpage at each position.

Referring to FIG. **14**, when including bump part **910**, it was confirmed that the maximum degree of warpage (Wmax 2) in the center portion and the edge region of the image sensor **810** had 4.42 μm, and it was confirmed that this was actually about 57% of the degree of warpage of the comparative example.

A camera module and an optical device including the camera module according to the embodiment include a bump part. The bump part may be formed by bonding a metal wire on a reinforcing plate. In this case, a region overlapping the image sensor in an optical axis direction among the upper surface of the reinforcing plate includes a region in which the bump part is disposed, and a region in which an adhesive member for attaching or fixing the image sensor is disposed. In other words, the adhesive member may be selectively disposed on a region of the upper surface of the reinforcing plate in which the bump part is not formed. In addition, the embodiment may be attached or fixed on the reinforcing plate by the adhesive member in a state in which at least a portion of the lower surface of the image sensor is in direct contact with and supported by the bump part. Accordingly, the embodiment may minimize a warpage phenomenon of the image sensor by allowing at least a part of the image sensor to directly contact and support the bump part, thereby improving the operation reliability of the camera module.

Furthermore, in the embodiment, at least a portion of the image sensor is in direct contact with the bump part, and the bump part is in direct contact with the reinforcing plate, so that heat generated from the image sensor can be efficiently transferred to the outside.

In addition, the embodiment allows an area of the adhesive member disposed on the lower surface of the image sensor to be smaller than an area of the lower surface of the image sensor. Accordingly, the embodiment may minimize the warpage phenomenon of the image sensor that occurs as an arrangement area of the adhesive member increases compared to the area of the image sensor.

In addition, the embodiment allows at least a portion of an edge region of an active pixel region of the image sensor to be supported by the bump part in the optical axis direction. Accordingly, the embodiment may secure the flatness of the active pixel region, thereby improving the quality of the image obtained by the image sensor.

FIG. **15** is a view illustrating a shape of a bump part according to another embodiment.

Referring to FIG. **15**, the bump part includes the first bump **910***a* and the second bump **910***b* described above. In this case, the first bump **910***a* and the second bump **910***b* have already been described with reference to FIG. **5**, and accordingly, a description thereof will be omitted.

The bump part **910** of the embodiment may include an extension part **910***c* disposed on the second bump **910***b*. The extension part **910***c* may protrude upward with a certain height from the upper surface of the second bump **910***b*. The extension part **910***c* may include a first portion having a trapezoidal shape and a second portion on the first portion. The first portion may be a part formed in a process of completing a bonding process after forming the second bump **910***b*. In addition, the second portion may be a portion where the metal wire is finally cut after the formation of the bump part **910** is completed. The extension part **910***c* may be a part formed in a process of finally cutting the metal wire after forming the second bump **910***b*. However, the extension part **910***c* may be removed by pressing force in a process of seating the image sensor **810** on the bump part **910**. For example, the extension part **910***c* may be removed by being pressed during the process of attaching or fixing the image sensor **810**. Preferably, the extension part **910***c* may be included in the second bump **910***b* by being pressed. However, at least a portion of the extension portion **910***c* may remain on the second bump **910***b* based on the pressing force generated in the process of attaching or fixing the image sensor **810** or the thickness of the first adhesive member **1750**. In addition, in this case, the second bump **910***b* may include a portion of the remaining extension part **910***c*.

FIG. **16** is a perspective view of a portable terminal **200**A according to an embodiment, and FIG. **17** is a block diagram of the portable terminal shown in FIG. **16**.

FIGS. **16** and **17**, the portable terminal (**200**A, hereinafter referred to as "terminal") may include a body **850**, a wireless communication unit **710**, an A/V input unit **720**, and a sensing unit **740**, an input/output unit **750**, a memory unit **760**, an interface unit **770**, a control unit **780**, and a power supply unit **790**.

The body **850** shown in FIG. **16** is in the form of a bar, but is not limited thereto, and there may be various structures such as a slide type, a folder type, a swing type, a swivel type, in which two or more sub-bodies are coupled to be movable relative to each other.

The body **850** may include a case (casing, housing, cover, etc.) forming an exterior. For example, the body **850** may be divided into a front case **851** and a rear case **852**. Various

electronic components of the terminal may be embedded in a space formed between the front case **851** and the rear case **852**.

The wireless communication unit **710** may include one or more modules that enable wireless communication between the terminal **200**A and the wireless communication system or between the terminal **200**A and the network in which the terminal **200**A is located. For example, the wireless communication unit **710** may include a broadcast reception module **711**, a mobile communication module **712**, a wireless internet module **713**, a short-range communication module **714**, and a location information module **715**.

The A/V (Audio/Video) input unit **720** is for inputting an audio signal or a video signal, and may include a camera **721** and a microphone **722** and the like.

The camera **721** may include a camera module according to the embodiment shown in FIG. **2**.

The sensing unit may detect a current state of the terminal **200**A, such as an opening/closing state of the terminal **200**A, a position of the terminal **200**A, a presence or absence of user contact, an orientation of the terminal **200**A, acceleration/deceleration of the terminal **200**A, etc. and generate a sensing signal for controlling the operation of the terminal **200**A. For example, when the terminal **200**A is in the form of a slide phone, it is possible to sense whether the slide phone is opened or closed. In addition, it is responsible for sensing functions related to whether the power supply unit **790** is supplied with power, whether the interface unit **770** is coupled to an external device, and the like.

The input/output unit **750** is for generating input or output related to sight, hearing, or touch. The input/output unit **750** may generate input data for operation control of the terminal **200**A, and may also display information processed by the terminal **200**A.

The input/output unit **750** may include a keypad unit **730**, a display module **751**, a sound output module **752**, and a touch screen panel **753**. The keypad unit **730** may generate input data in response to a keypad input.

The display module **751** may include a plurality of pixels whose color changes according to an electrical signal. For example, the display module **751** may include at least of a liquid crystal display, a thin film transistor-liquid crystal display, an organic light-emitting diode, a flexible display, three-dimensional display (3D display).

The sound output module **752** may output audio data received from the wireless communication unit **710** in a call signal reception, a call mode, a recording mode, a voice recognition mode, or a broadcast reception mode, or the like; or audio data stored in the memory unit **760**.

The touch screen panel **753** may convert a change in capacitance generated due to a user's touch on a specific region of the touch screen into an electrical input signal.

The memory unit **760** may store a program for processing and control of the controller **780**, and may temporarily store input/output data (eg, phone book, message, audio, still image, photo, video, etc.). For example, the memory unit **760** may store an image captured by the camera **721**, for example, a photo or a moving picture.

The interface unit **770** serves as a passage for connecting with an external device connected to the terminal **200**A. The interface unit **770** receives data from an external device, receives power and transmits it to each component inside the terminal **200**A, or transmits data of the terminal **200**A to an external device. For example, the interface unit **770** may include a wired/wireless headset port, an external charger port, a wired/wireless data port, a memory card port, a port for connecting a device having an identification module, and an audio I/O (Input/Output) port, video I/O (Input/Output) port, and an earphone port, and the like.

The controller (controller, **780**) may control the overall operation of the terminal **200**A. For example, the controller **780** may perform related control and processing for voice calls, data communications, video calls, and the like.

The controller **780** may include a multimedia module **781** for playing multimedia. The multimedia module **781** may be implemented within the controller **180** or may be implemented separately from the controller **780**.

The controller **780** may perform a pattern recognition process capable of recognizing a handwriting input or a drawing input performed on the touch screen as characters and images, respectively.

The power supply unit **790** may receive external power or internal power under the control of the control unit **780** to supply power required for the operation of each component.

Although the embodiments of the present invention have been described with reference to the accompanying drawings, those skilled in the art to which the present invention pertains will be understood that the present invention may be implemented in other specific forms without modifying the technical spirit and essential features of the present invention. Therefore, it should be understood that the embodiments described above are illustrative in all aspects and not restrictive.

What is claimed is:

1. A camera module comprising:
- a reinforcing plate;
- a bump part disposed on the reinforcing plate;
- a first adhesive member disposed on the reinforcing plate;
- a circuit board disposed on the reinforcing plate and including a cavity vertically overlapping the bump part and the first adhesive member; and
- an image sensor disposed on the bump part and the first adhesive member,
- wherein the image sensor is supported by the bump part and is disposed in the cavity, and
- wherein the image sensor overlaps the first adhesive member and the bump part in a vertical direction, and the first adhesive member is spaced apart from the bump part in a horizontal direction.

2. The camera module of claim **1**, wherein the bump part includes:
- a first bump disposed on the reinforcing plate and having a first height; and
- a second bump disposed on the first bump and having a second height different from the first height; and
- wherein an upper surface of the second bump is in direct contact with a lower surface of the image sensor.

3. The camera module of claim **2**, wherein a side surface of each of the first bump and the second bump includes a curved surface.

4. The camera module of claim **2**, wherein the reinforcing plate includes a region vertically overlapping the cavity, and
- wherein the bump part is disposed in plurality on the region vertically overlapping the cavity on the upper surface of the reinforcing plate.

5. The camera module of claim **1**, wherein a thickness of the bump part is same as a thickness of the first adhesive member.

6. The camera module of claim **2**, wherein the bump part is composed of a metal wire having a diameter in a range of 22 μm to 28 μm.

7. The camera module of claim **6**, wherein the first height of the first bump is in a range of 50% to 90% of the diameter of the metal wire.

8. The camera module of claim 6, wherein the second height of the second bump is in a range of 115% to 170% of the diameter of the metal wire.

9. The camera module of claim 7, wherein the first height of the first bump is in a range of 11 μm to 26 μm.

10. The camera module of claim 8, wherein the second height of the second bump is in a range of 28 μm to 44 μm.

11. The camera module of claim 2, wherein the first bump has a first width, and

wherein the second bump has a second width smaller than the first width.

12. The camera module of claim 11, wherein the first width of the first bump is in a range of 70 μm to 97 μm; and

wherein the second width of the second bump is in a range of 50 μm to 80 μm.

13. The camera module of claim 1, comprising:

a second adhesive member disposed between the circuit board and the reinforcing plate,

wherein a thickness of the second adhesive member is smaller than a thickness of the first adhesive member.

14. The camera module of claim 1, wherein an area of the first adhesive member is 50% or less of an area of the image sensor.

15. The camera module of claim 4, wherein the plurality of bump parts overlap a corner region of the lower surface of the image sensor in an optical axis direction.

16. The camera module of claim 1, wherein the bump part is spaced apart from an inner wall of the cavity of the circuit board by a first separation distance.

17. The camera module of claim 2, wherein the image sensor includes a pixel region and a non-pixel region around the pixel region, and

wherein the bump part overlaps the pixel region of the image sensor in an optical axis direction.

18. The camera module of claim 17, wherein the pixel region of the image sensor includes:

an active pixel region; and

a dummy pixel region between the active pixel region and the passivation non-pixel region; and

wherein at least a portion of the second bump of the bump part overlaps the active pixel region in the optical axis direction.

19. The camera module of claim 6, wherein the circuit board includes a first terminal,

wherein the image sensor includes a second terminal,

wherein the camera module comprises a connection wire electrically connecting the first terminal and the second terminal, and

wherein the connection wire includes a same material as a material of the metal wire constituting the bump part.

20. An optical device comprising:

a body, a camera module disposed at the body and configured to capture an image of a subject, and a display unit disposed at the body and configured to output the image captured by the camera module,

wherein the camera module comprises:

a reinforcing plate;

a circuit board disposed on the reinforcing plate and including a cavity and a first terminal;

a bump part disposed on the reinforcing plate and exposed through the cavity of the circuit board;

a first adhesive member disposed on the reinforcing plate;

an image sensor disposed on the bump part and the first adhesive member and including a second terminal; and

a wire part connecting the first terminal and the second terminal,

wherein the bump part includes a first bump disposed on the reinforcing plate and having a first height; and a second bump disposed on the first bump and having a second height different from the first height;

wherein an upper surface of the second bump is in direct contact with a lower surface of the image sensor;

wherein the bump part is composed of a metal wire having a diameter in a range of 22 μm to 28 μm,

wherein the first height of the first bump is in a range of 50% to 90% of the diameter of the metal wire,

wherein the second height of the second bump is in a range of 115% to 170% of the diameter of the metal wire,

wherein the image sensor overlaps the first adhesive member and the bump part in a vertical direction, and the first adhesive member is spaced apart from the bump part in a horizontal direction, and

wherein a thickness of the bump part is same as a thickness of the first adhesive member.

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