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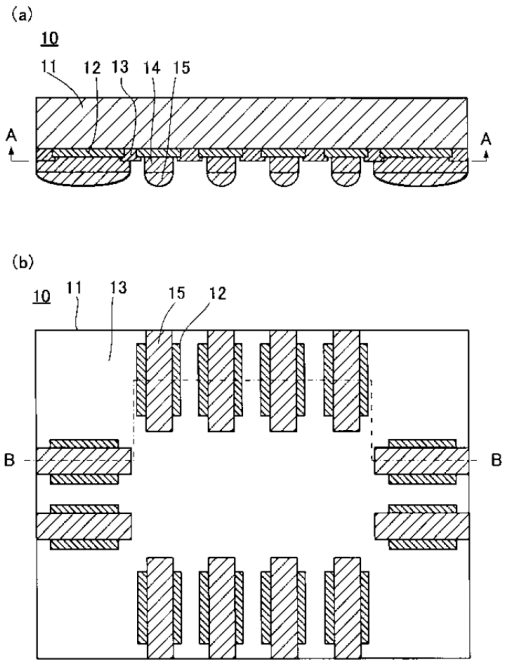
(54) [Title of Invention] ELECTRONIC COMPONENT AND MODULE

(57) [Abstract] (Revised)
[Problem] To provide an electronic component and a module wherein a bonding area can be increased and failure of a bonding part between a bump and an element can be prevented, even when a bump or columnar electrode is formed at a narrow pitch.
[Resolution Means] Bumps 15, which are formed on pads 12 of an element 11, are formed thereon so as to protrude further in the longitudinal direction of the pads 12 than the pads 12 themselves. This allows for an increased bonding area of the bumps, and enables the suppression of bump failure caused by thermal stress while mounting. Moreover, the bumps do not protrude in the direction of lateral adjacency to one another, therefore, bump failure caused by thermal stress while mounting can be suppressed and the distance between adjacent bumps can be ensured, allowing for the prevention of short circuiting between bumps.
[Selected Drawing] FIG. 1



[Scope of Patent Claims]
[Claim 1]
An electronic component, comprising: an element having a plurality of sides; a plurality of pads formed on a mounting surface of the element; and bumps formed on the pad, wherein the bumps are formed on the pad as well as on the mounting surface of the element at a periphery of the pad.
[Claim 2]
The electronic component according to claim 1, wherein the portion formed on the mounting surface of the element of the bumps is a region between the side of the mounting surface of the element and the pad and/or a region interposing the region and the pad on the opposite side.
[Claim 3]
The electronic component according to claim 1 or 2, wherein columnar electrodes are formed on the pad, and the bumps are formed on the columnar electrodes.
[Claim 4]
The electronic component according to any one of claims 1 to 3, wherein a planar shape of the bumps is that of a longitudinal form in which the direction orthogonal to the peripheral side of the mounting surface of the element forms a long side thereof.
[Claim 5]
The electronic component according to any one of claims 1 to 4, wherein the bumps are formed into a shape that does not protrude from the bumps in the direction parallel to the peripheral side of the mounting surface of the element.
[Claim 6]
The electronic component according to any one of claims 1 to 5, wherein the pad is peripherally arrayed on the mounting surface of the element.
[Claim 7]
The electronic component according to any one of claims 1 to 7, being of a shape equivalent to that of the mounted electrodes of the board on which the planar shape of the bumps is formed.
[Claim 8]
A module, comprising: the electronic component according to any one of claims 1 to 7, and the board on which the electronic component is mounted.
[Claim 9]
The module according to claim 8, wherein a planar shape of the mounted electrodes is that of a longitudinal form in which the direction orthogonal to the peripheral side of the mounting surface of the board forms a long side thereof.
[Detailed Description of Invention]
[Technical Field]
[0001]
This invention relates to electronic components and modules. In particular, this invention relates to electronic components which include a bonding structure for bonding to a board, as well as to modules which use these electronic components.
[Background Art]
[0002]
In recent years, the miniaturization and induction of high functionality in electronic devices have led to a demand for high-density mounting in electronic components. In this context, flip chip mounting is generally utilized when mounting electronic components onto a board. Such flip chip mounting generally involves providing bumps on the electronic component and soldering the electronic component to the board by reflow.
[0003]
In particular, the electronic component including bumps which is disclosed in Patent Document 1 is known to be suitable for flip chip mounting of electronic components onto a board formed at a narrow pitch. FIG. 6 illustrates this electronic component 80. A illustrated in FIG. 6, the electronic component 80 is composed of a structure wherein a plurality of pads 82 are provided on the mounting surface of an element 81. More

specifically, an insulating film 83 is applied to the mounting surface of the element 81, a portion of the plurality of pads 82 portions is opened, a columnar electrode 84 is included on the pad 82, and a bump 85 is provided on the columnar electrode 84. By forming the bump 85 on the columnar electrode 84, adjacent bumps as well as an edge distance therebetween are ensured.

[Prior Art Documents]

[Patent Documents]

[0004]

[Patent Document 1] JP 2006-202969 A

[Summary of Invention]

[Problem to Be Solved by Invention]

[0005]

However, accompanying the miniaturization of elements resulting from the miniaturization and induction of high functionality in electronic mechanisms and the like, pad pitches are decreasing, and columnar electrodes are also being formed in a more narrow and miniature manner. Therefore, in the configuration of Patent Document 1, the bonding area between the columnar electrodes and the pad is made smaller, which leads to a problem where the base of the columnar electrodes breaks due to thermal stress while mounting.

[0006]

Thus, an object of this invention is to provide an electronic component and a module of a configuration wherein a bonding area can be increased and failure of a bonding part between a bump and an element can be prevented, even in the case that a bump or columnar electrode is formed at a narrow pitch.

[Means for Solving Problem]

[0007]

The electronic component of this invention includes: an element having a plurality of sides, a plurality of pads formed on a mounting surface of the element, and bumps formed on the pad, wherein the bumps are formed on the pad as well as on the mounting surface of the element at a periphery of the pad.

[0008]

The shape of the bumps as such allows for an increase in the bonding area of the bumps, and therefore strengthens the bond strength of the bumps. In addition, bump failure due thermal stress when mounting the element as well as when further mounting the module to which the element is mounted onto a circuit board can be suppressed.

[0009]

Moreover, in the electronic component of this invention, a portion formed on the mounting surface of the element of the bumps is preferably a region between the side of the mounting surface of the element and the pad and/or a region interposing the region and the pad on the opposite side. In this manner, the bonding area between adjacent bumps and in the direction orthogonal thereto can be increased, without the locations at which the bumps are formed on the mounting surface of the element enlarging between the adjacent bumps. Therefore, the bonding area of the bumps can be increased while ensuring the distance between the adjacent bumps, thus preventing short circuits between the bumps.

[0010]

In addition, the electronic component of this invention preferably has columnar electrodes formed on the pad, with the bumps being formed on the columnar electrodes. In this case, by forming the bumps on the columnar electrodes, the bumps can be formed at a position higher than that of the pad, which increases the effect of suppressing against bond failure of the bumps caused by thermal stress due to a difference in thermal expansion between the element and the board while mounting.

[0011]

Moreover, in the electronic component of this invention, the electronic component preferably has a longitudinal form in which the direction of the bumps orthogonal to the peripheral side of the mounting surface of the element forms a long side thereof.

[0012]

In addition, in the electronic component of this invention, the electronic component is preferably formed into a shape wherein the electronic component has bumps that do not protrude from the pad in the direction parallel to the side of the mounting surface of the element.

[0013]

Moreover, in the electronic component of this invention, the pad is peripherally arrayed on the mounting

surface of the element.

[0014]

Furthermore, the electronic component of this invention preferably has a form equivalent to that of the mounted electrodes of the board on which the planar shape of the bumps is formed. By making the shape of the bumps and the shape of the mounted electrodes substantially identical, the concentration of stress in terms of thermal stress following mounting can be alleviated, and bump failure can be prevented.

[0015]

Additionally, the module of this invention is preferably configured by mounting the electronic component onto the board.

[0016]

Moreover, in the module of this invention, the planar shape of the mounted electrodes is that of a longitudinal form in which the direction orthogonal to the peripheral side of the mounting surface of the board forms a long side thereof.

[Effect of Invention]

[0017]

In the electronic component of this invention, the bump shape allows for an increased bonding area of the bumps, and therefore enables the suppression of bump failure caused by thermal stress while mounting.

[Brief Description of Drawings]

[0018]

[FIG. 1] A transverse cross-sectional view and a horizontal cross-sectional view of the electronic component according to embodiment 1 of this invention.

[FIG. 2] A transverse cross-sectional view for describing a formation step of the electronic component according to embodiment 1.

[FIG. 3] A transverse cross-sectional view for describing a formation step following the formation step of FIG. 2.

[FIG. 4] A horizontal cross-sectional view of the module according to embodiment 2 of this invention.

[FIG. 5] A transverse cross-sectional view of the module according to embodiment 2 of this invention.

[FIG. 6] A transverse cross-sectional view of a conventional electronic component.

[Embodiments of Invention]

[0019]

Embodiments of this invention will be described hereinafter.

(Embodiment 1)

The electronic component of embodiment 1 will be described using FIG. 1.

[0020]

FIG. 1 illustrates an electronic component 10 according to embodiment 1. The electronic component 10 has an element 11, with the element 11 including a mounting surface provided with a plurality of pads 12. The element 11 is a semiconductor element or the like, and is rectangular in shape. The pads formed on the element 11 are, therefore, also rectangular in shape. The rectangular shapes of the element 11 and the pads 12 include true rectangles as well as squares, and may acceptably have rounded corners, missing corners, or shapes having a notch or cut-out. The shapes may also acceptably be circular or polygonal. The pads 12 are formed of Al, however, another metal such as Cu or Au is also acceptable. As illustrated in FIG. 1(b), the pads 12 are arranged at a circumferential part on the mounting surface of the element 11. This arrangement is called a peripheral arrangement. However, scattering of some of the pads 12 further inward from the peripheral arrangement is also acceptable. An insulating film 13 of SiN or the like is provided on the mounting surface of the element 11, and at the portions where the pads 12 are formed, a window is opened in the insulating film 13, after which the pads 12 are formed.

[0021]

First, columnar electrodes 14 are formed on the pads 12, and also protrude onto a mounting surface of the element 11 which is continuous with a region at which the pads 12 are provided, and bumps 15 are formed on the columnar electrodes 14 thereof. The bumps 15 are also formed on the columnar electrodes 14, on the pads 12 via identical planar formation, and protruding onto the mounting surface of the element 11 at the periphery of the pads 12. The portion formed on the mounting surface of the element 11 of the bumps 15 is: the region between the side of the mounting surface of the element 11 and the pads 12, and/or the region is: the region interposing the pads 12 on the side opposite the side of the mounting surface of the element 11. As such, the locations at which the bumps 15 are formed on the mounting surface of the element 11 are formed protruding from the pads 12 in the direction orthogonal to the direction of adjacent bumps without protruding from the pads 12 in the direction of the adjacent bumps for each of the bumps 15. Therefore, the distance between the adjacent bumps can be

ensured, preventing short circuits between the bumps. Furthermore, bump failure due thermal stress when mounting the element as well as when further mounting the module to which the element is mounted onto a circuit board can be suppressed.

[0022]

Note that the bumps 15 may also acceptably be formed directly on the pads 12, without the formation of the columnar electrodes 14.

[0023]

Next, a manufacturing method of the electronic component, with respect to the manufacturing method of the electronic component according to embodiment 1, will be explained with reference to FIGS. 2 and 3.

[0024]

First, with a semiconductor or the like such as that illustrated in FIG. 2(a), the element 11 on which the pads 12 are formed is prepared. The dimensions of the pads 12 are 52 × 65 μm, and a pad pitch of 80 μm is used.

[0025]

A portion of the pads 12 is caused to open on the element 11, and the insulating film 13 is provided as illustrated in FIG. 2(a). The insulating film 13 may be provided using an inorganic film such as that of SiN or SiO_2, or an organic film such as that of a polyimide or PBO. As illustrated in FIG. 2(b), a seed film 51 is formed on the element 11 on which the pads 12 and the insulating film 13 are provided. The seed film 51 is formed of Cu/Ti, but another configuration is also acceptable. The method of forming the seed film 51 is generally that of sputtering, but vapor deposition and electroless plating are also acceptable. Next, a resist 52 is also formed, as illustrated in FIG. 2(b). In forming the resist 52, first, a photosensitive resin layer of a predetermined thickness is formed on the element 11 using a spin coating method or printing method. Formation via a type of resist which is adhered using a photosensitive film may also acceptably be used. Subsequently, a photomask having an opening of 40 × 250 μm serving as the resist 52 is superimposed, irradiated with ultraviolet light, and subjected to lithographic exposure. Immersion in a chemical solution (processing) is performed, removing the resin layer of the portion blocked by the photomask, and the resist 52 is formed. Next, as illustrated in FIG. 2(c), at the opening of the resist 52, Ni plating is formed at 5 μm, Cu plating at 30 μm, and SnAg plating at 10 μm. The Cu plating part serves as the columnar electrodes 14. The SnAg plating part serves as the bumps 15. It is important here that the plating quantities be carefully adjusted. Thereafter, the resist 52 is detached, as illustrated in FIG. 3(d). Furthermore, as illustrated in FIG. 3(e), the columnar electrodes 14 and the bumps 15 remain, and the seed film 51 is removed by etching. Lastly, a reflow process is performed, and the bumps 15 are rounded, as illustrated in FIG. 3(f).

[0026]

Following formation of the bumps 15, the shear strength of one bump was measured. The test method was conducted according to shear test 3.3.6 of the EIAJ reliability test ED-4701/400-1. The tool height was set to 10 ± 5 μm, and the tool speed was set to 300 ± 50 μm/sec. A conventional 40 μm φ round bump and a rectangular bump of this embodiment were formed on elements including pads of the same shapes, respectively, and were compared. The conventional 40 μm φ round bump had a shear strength of 240 mN. For the rectangular bump of this embodiment, a bonding strength of 1,300 mN was obtained as the measurement result, being five times that obtained conventionally, or more.

(Embodiment 2)

FIGS. 4 and 5 illustrate a module 20 wherein an electronic component 110 according to embodiment 2 is mounted to a board 121.

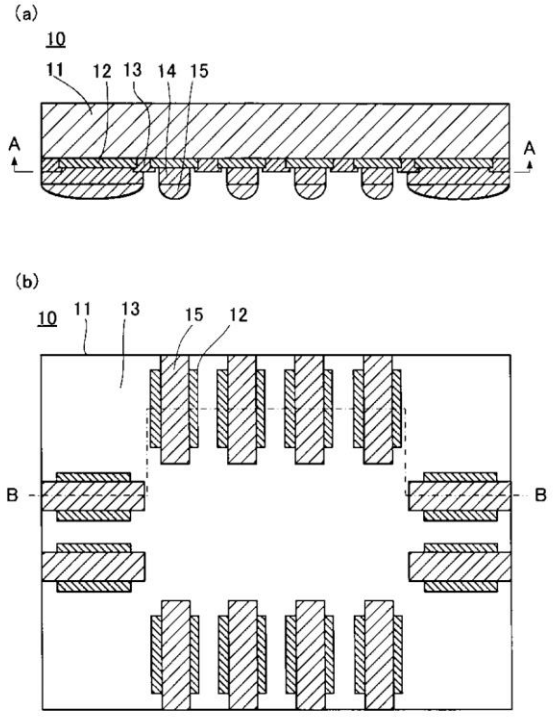
[0027]

The module 20 includes the board 121, which is provided with a plurality of mounted electrodes 122. Columnar electrodes 114 of the electronic component 110 as well as the mounted electrodes 122 of the board 121 are connected via bumps 115 composed of SnAg, and are mounted onto the board 121. In the module 20, the planar shape of the bumps 115 of the electronic component 110 and the planar shape of the mounted electrodes 122 of the board 121 are substantially identical. By making the planar shape of the bumps 115 and the planar shape of the mounted electrodes 122 substantially identical, the concentration of stress in terms of thermal stress following mounting can be alleviated, and bump failure can be prevented.

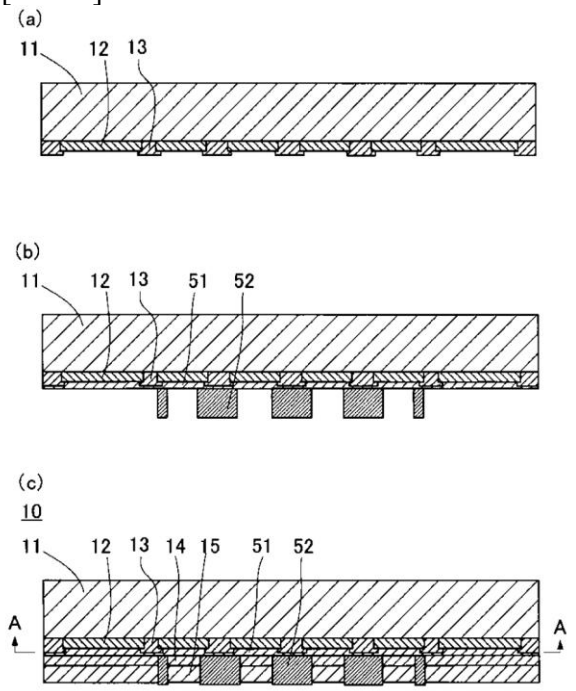
[Description of Reference Numerals]

[0028]
10, 80, 100... Electronic component
11, 81, 111... Element
12, 82, 112... Pads
13, 83, 113... Insulating film
14, 84, 114... Columnar electrodes
15, 85, 115... Bumps
20... Module
21, 121... Board
22, 122... Mounted electrodes
51... Seed film
52... Resist

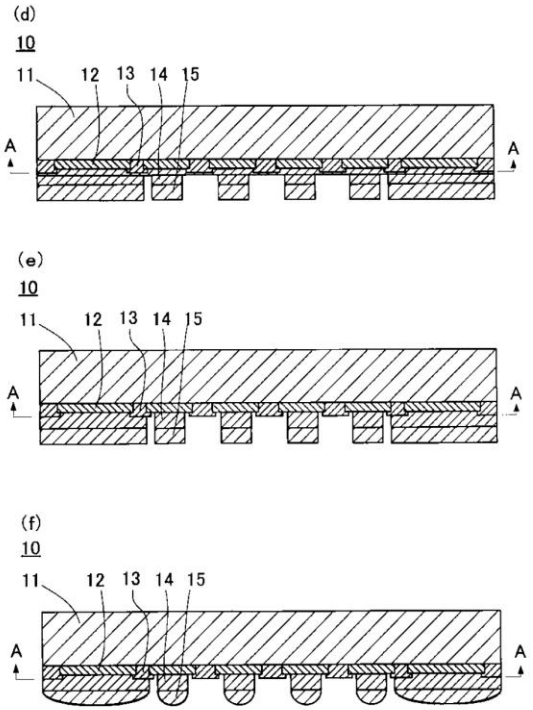
[FIG. 1]



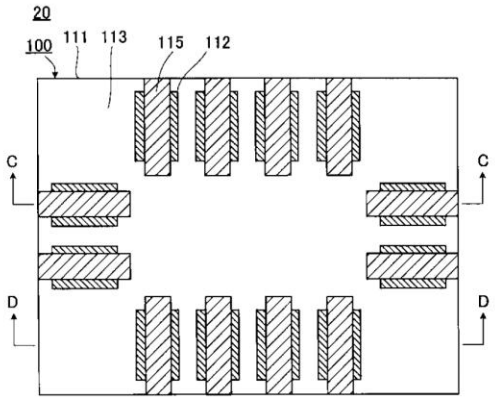
[FIG. 2]



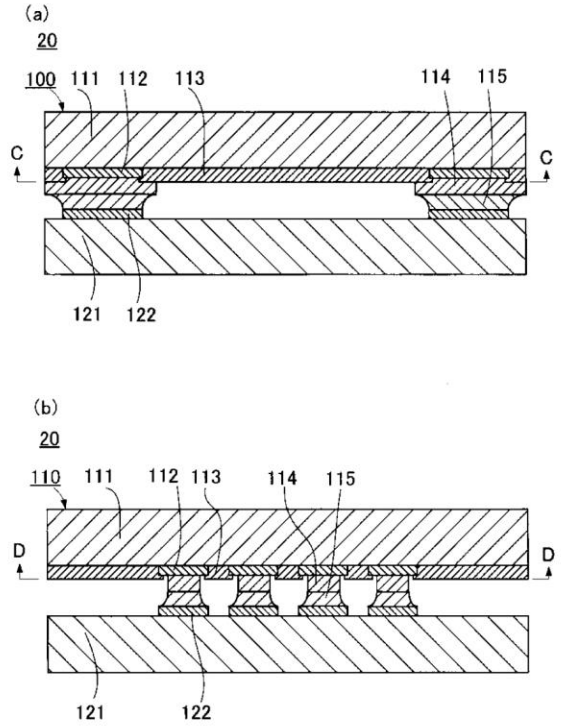
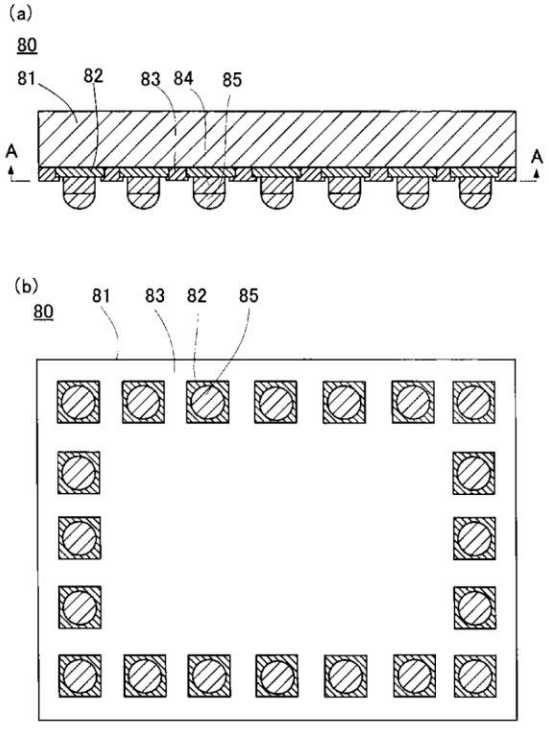
[FIG. 3]



[FIG. 4]



[FIG. 5]



[FIG. 6]