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Cho et al.

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(54) **METHOD FOR MANUFACTURING SEMICONDUCTOR PACKAGE CONTAINING CYLINDRICAL TYPE BUMP GRID ARRAY**

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(22) Filed: **Oct. 6, 2000**

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Aug. 4, 1998 (KR) 98-31705

(51) **Int. Cl.**[7] **H01L 21/44**
(52) **U.S. Cl.** **438/613**; 438/108; 438/121; 228/180.22; 29/840; 29/843
(58) **Field of Search** 228/180.21, 180.22; 438/106, 108, 109, 121, 612, 613, 112; 257/737, 738, 778; 29/800, 843, 844

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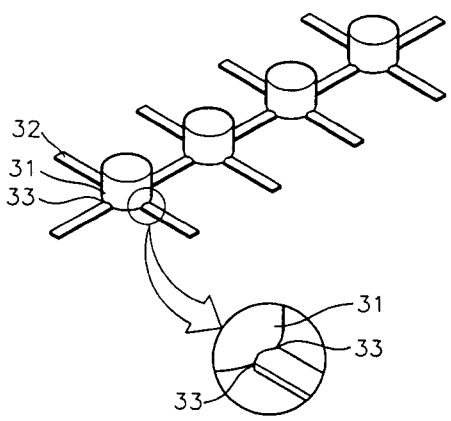
(57) **ABSTRACT**

A method for manufacturing a semiconductor package comprising the steps of (a) forming a plurality of bumps on a metal frame and a bridge for connecting and supporting the bumps, (b) coating liquid solder on the bumps, (c) aligning the frame with respect to a semiconductor substrate where patterns are formed so that the bumps are positioned on the patterns, (d) soldering the bumps on the patterns, and (e) separating the bumps from the frame by breaking a connecting portion of the bumps and the bridge.

5 Claims, 5 Drawing Sheets



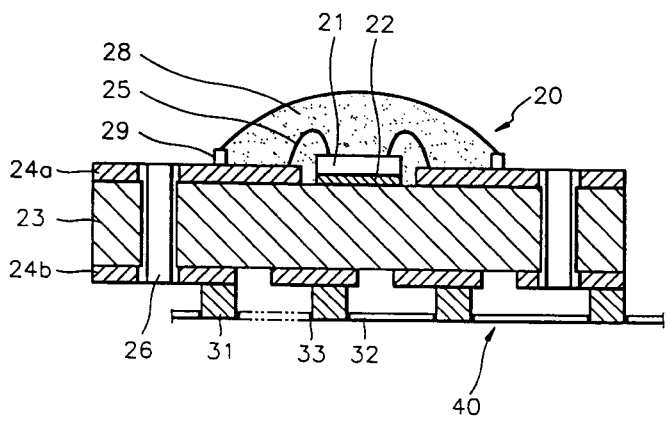


FIG. 1(PRIOR ART)

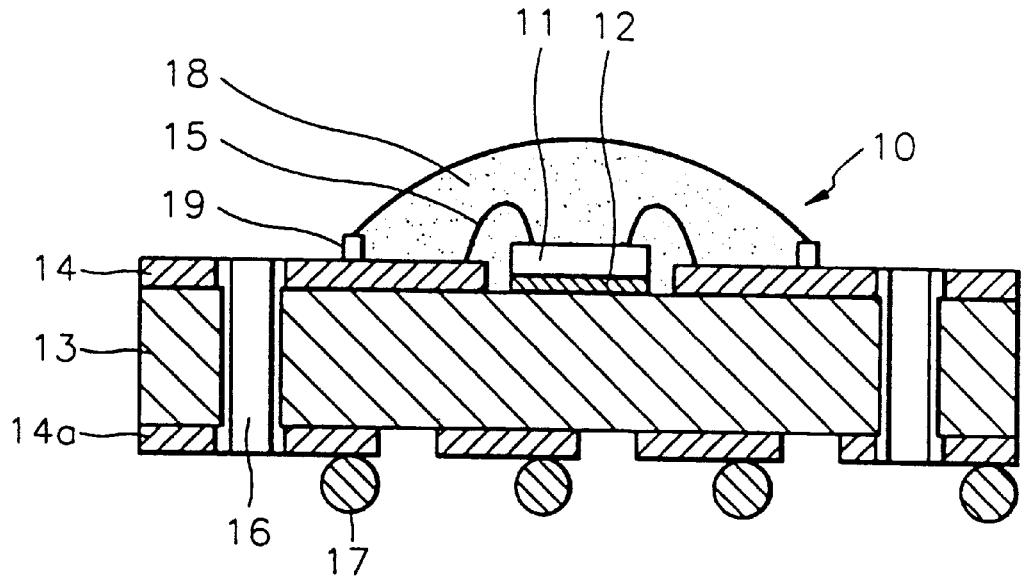


FIG. 2

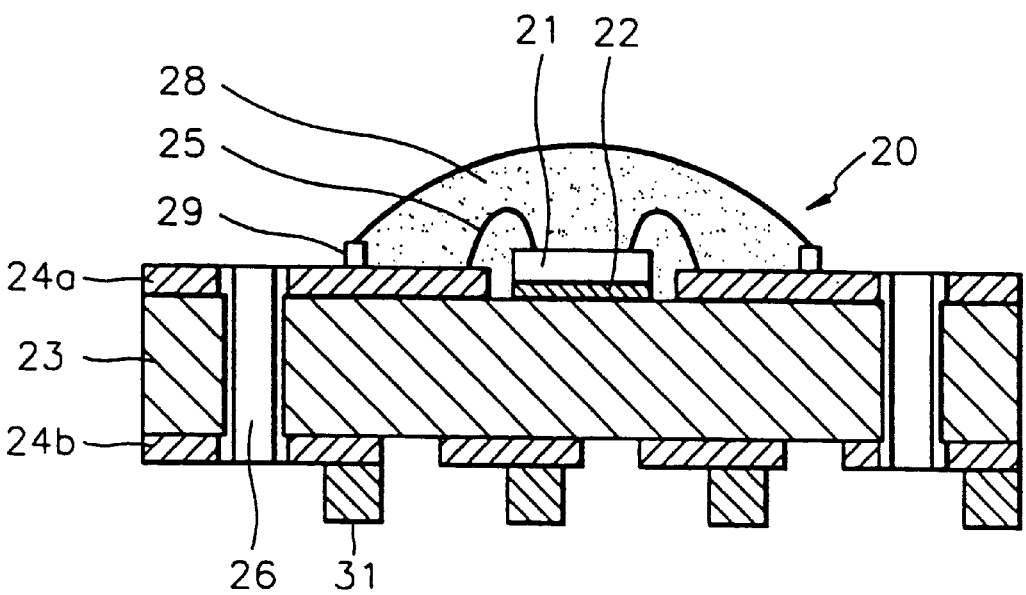


FIG.3

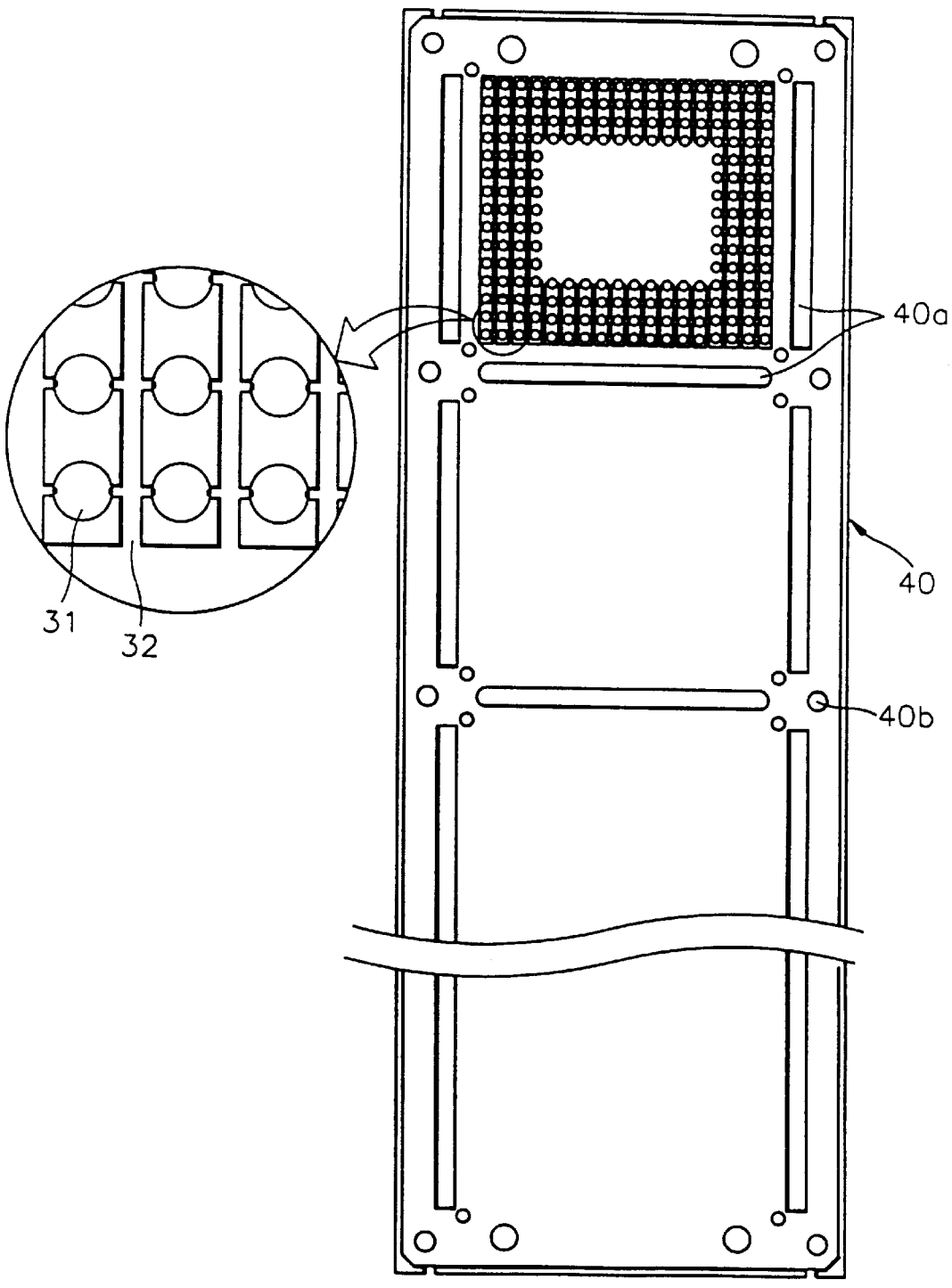


FIG.4

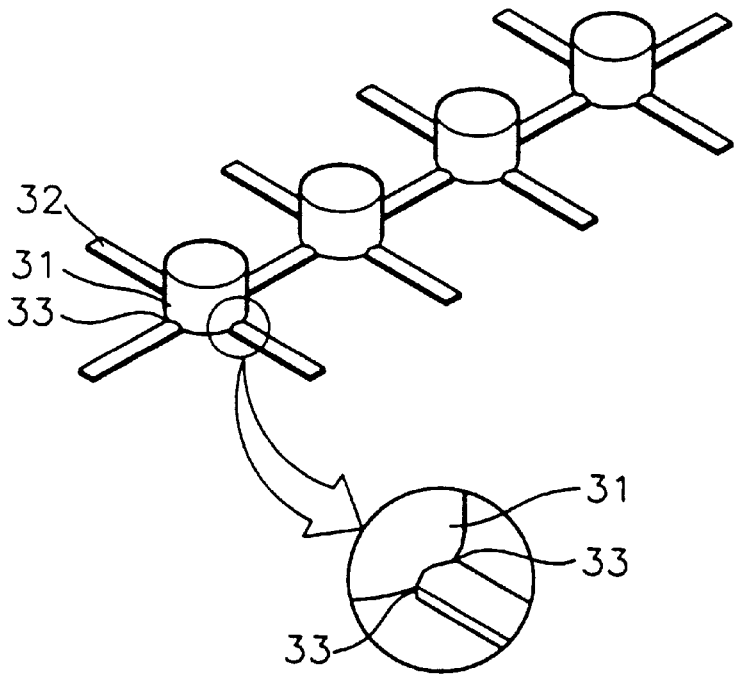


FIG.5

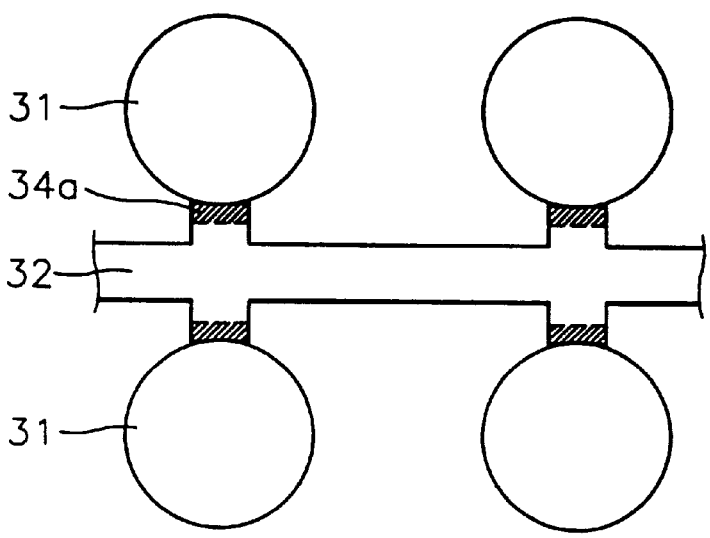


FIG.6

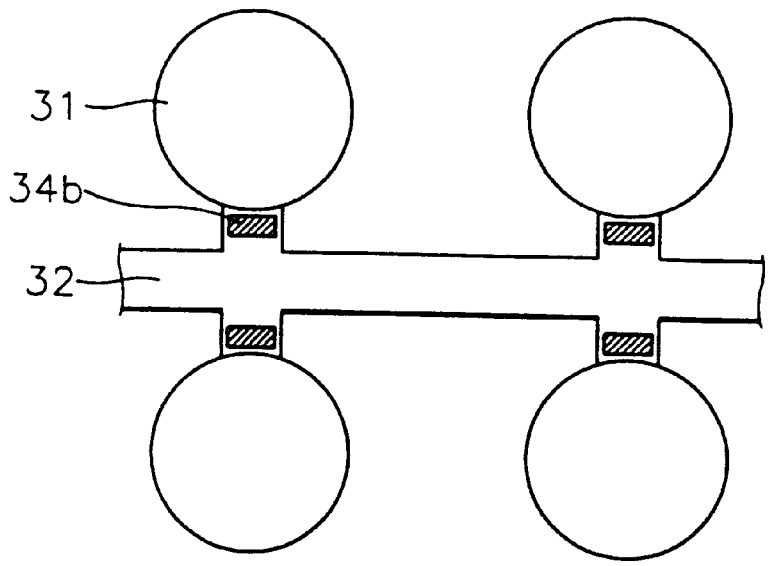


FIG.7

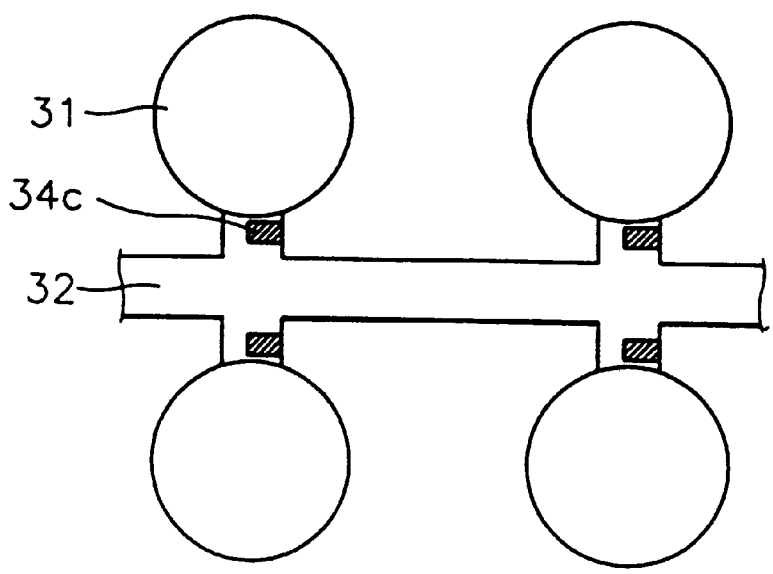


FIG.8

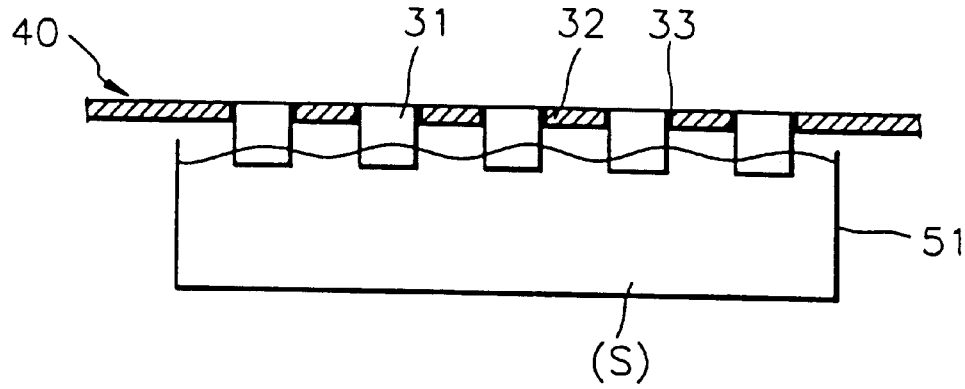
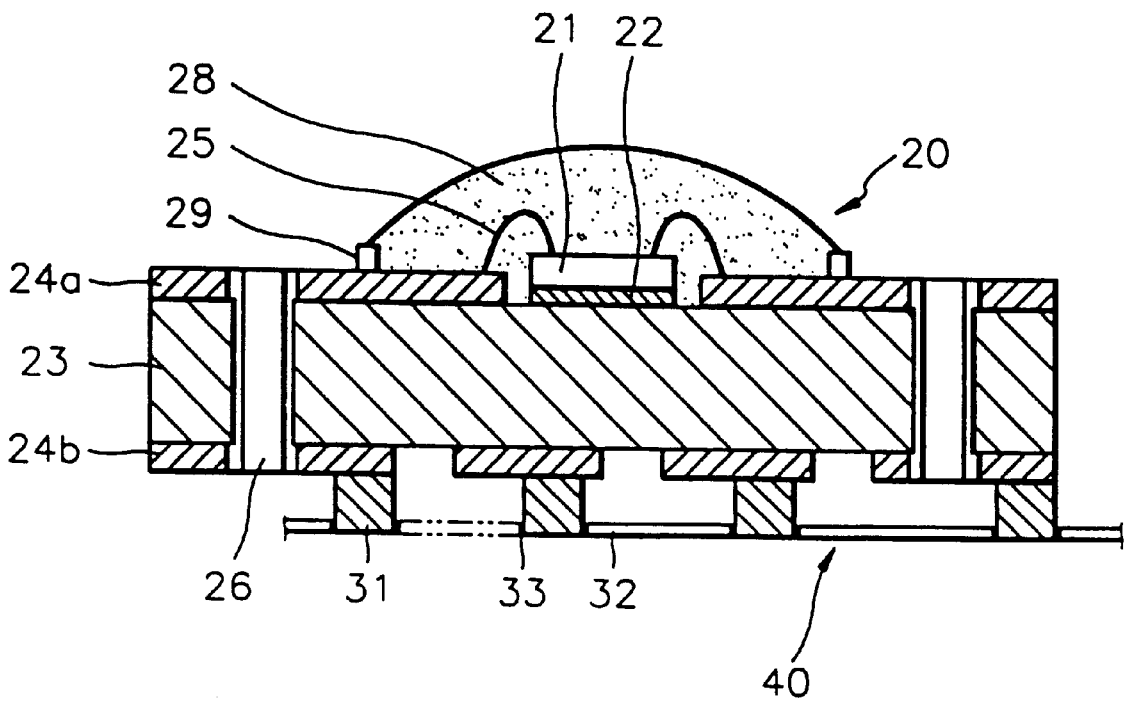


FIG.9



METHOD FOR MANUFACTURING SEMICONDUCTOR PACKAGE CONTAINING CYLINDRICAL TYPE BUMP GRID ARRAY

This is a division of application Ser. No. 09/221,598, filed Dec. 29, 1998, now abandoned all of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a semiconductor package, and more particularly, to a bump grid array package which is an improvement of a ball grid array package, and a manufacturing method therefor.

2. Description of the Related Art

A general semiconductor package is manufactured by mounting a semiconductor chip on a pad or a substrate and molding the semiconductor chip using resin, with connection means electrically connected with an external circuit substrate being provided in the lower surface of the substrate.

Referring to FIG. **1** showing a ball grid array package **10** which is a kind of the semiconductor package, a semiconductor chip **11** is bonded on a substrate **13** of the package **10** by a bonding agent **12**. Patterns **14** and **14***a* are formed on upper and lower surfaces of the substrate **13**, respectively. The patterns **14** and **14***a* are electrically connected with each other through a throughhole **16** formed to penetrate the substrate **13**. Also, the upper pattern **14** is wire-bonded to the semiconductor chip **11** by a bonding wire **15**, and a solder ball **17** is provided on the lower pattern **14***a*.

Also, in order to protect the semiconductor chip **11** and the bonding wire **15**, the semiconductor chip **11** and the bonding wire **15** are molded using epoxy resin **18**. Here, a dam **19** is formed on a predetermined position of the substrate **13** so that the epoxy resin **18** may not spread too widely on the upper surface of the substrate **13**.

In fabricating the ball grid array package **10**, the solder ball **17** having a diameter of 0.75 mm or less is placed on the lower pattern **14***a* of the substrate **13** and then soldered at a high temperature to then be bonded to the lower pattern **14***a*.

However, when the solder ball **17** is aligned on the lower pattern **14***a* for bonding the same thereon, the solder ball **17** may move, which causes misalignment of the solder ball **17**, generation of double balls due to neighboring balls sticking to each other, or missing balls.

SUMMARY OF THE INVENTION

To solve the above problems, it is desirable to provide a method for manufacturing a stable semiconductor package by employing bumps which are cylindrical or whose cross-sectional shapes are constant and a frame for supporting the bumps, and the semiconductor package manufactured thereby.

Accordingly, there is provided a method for manufacturing a semiconductor package comprising the steps of (a) forming a plurality of bumps on a metal frame and a bridge for connecting and supporting the bumps, (b) coating liquid solder on the bumps, (c) aligning the frame with respect to a semiconductor substrate where patterns are formed so that the bumps are positioned on the patterns, (d) soldering the bumps on the patterns, and (e) separating the bumps from the frame by breaking a connecting portion of the bumps and the bridge.

Here, the step (a) comprises the steps of coating a photosensitive material on the metal frame, exposing the metal frame using a mask where patterns corresponding to the bumps and the bridge are formed, developing the metal frame, and etching the metal frame to form the bumps and the bridge.

Also, the method may further comprise the step of forming a notch at an end of the bridge connected to the bumps.

Alternatively, it is preferred that the method further comprises the step of half-etching the end of the bridge to form fracture portions at the end of the bridge connected to the bumps.

According to another aspect of the present invention, a semiconductor package comprising a substrate, a semiconductor chip mounted on the upper surface of the substrate, a first pattern formed on the upper surface of the substrate to be electrically connected with the semiconductor chip, a second pattern formed on the lower surface of the substrate to be electrically connected with the first pattern through throughholes formed to penetrate the substrate, and bumps which are cylindrical or whose cross-sectional shapes are constant, bonded on the second pattern.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objective and advantages of the present invention will become more apparent by describing in detail a preferred embodiment thereof with reference to the attached drawings in which:

FIG. **1** is a cross-sectional view illustrating a conventional ball grid array package;

FIG. **2** is a cross-sectional view illustrating a bump grid array package according to the present invention;

FIG. **3** is a plan view illustrating a metal frame having bumps employed in a semiconductor manufacturing method according to the present invention;

FIG. **4** is a perspective view illustrating the bumps and a bridge shown in FIG. **3**;

FIGS. **5** through **7** are plan views illustrating various examples of a connecting portion of the bumps and the bridge;

FIG. **8** is a side view illustrating a process of coating liquid solder on the bumps according to the present invention; and

FIG. **9** is a side sectional view illustrating a state where the frame having bumps is aligned on a substrate.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **2** showing a bump grid array package **20** according to the present invention, a semiconductor chip **21** is bonded on a substrate **23** by an adhesive **22**, and patterns **24***a* and **24***b* are formed on upper and lower surfaces of the substrate **23**, respectively. The upper pattern **24***a* is electrically connected with the semiconductor chip **21** by a bonding wire **25**. The lower pattern **24***b* is electrically connected with the upper pattern **24***a* through a plurality of throughholes **26** formed to penetrate the substrate **23**.

Also, in order to protect the semiconductor chip **21** and the bonding wire **25**, they are molded using epoxy resin **28**. Here, a dam **29** is formed at a predetermined position of the substrate **23** so that the epoxy resin **28** may not spread on the upper surface of the substrate **23** too widely.

According to the features of the present invention, a plurality of cylindrical bumps **31** are bonded on the lower pattern **24***b*. The shapes of the bumps **31** are preferably cylindrical. However, the shapes of the bumps **31** are not

limited to cylindrical shapes. The only restriction is that the cross-sectional shapes thereof have to be constant. In other words, the shapes and sizes of the bumps **31** have to be the same with one another.

Now, the method for bonding the bumps **31** will be described.

The bumps **31**, as shown in FIGS. **3** and **4**, are formed in a metal frame **40**. In other words, the plurality of bumps **31** are connected to a bridge **32** integrally formed with the frame **40** to then be supported. A guide slot **40***a* and a guide hole **40***b* are formed in the frame **40** for alignment of the bumps **31**. The frame **40** is preferably formed of copper having excellent heat conductivity for facilitating soldering.

The method for forming the bumps **31** in the frame **40** will be described. First, a degreasing operation for removing foreign matter on the surface of the frame is performed using an acid or alkaline solution, and then photoresist which is a photosensitive material is coated on the surface of the frame **40**.

Subsequently, the upper and lower surfaces of the frame **40** are exposed to light using a mask having a pattern corresponding to the bumps **31** and the bridge **32** connecting the bumps **31**. If the exposure is completed, the photoresist is developed and then the frame **40** is etched.

In such a manner, the plurality of cylindrical bumps **31** and the bridge **32** connected with the bumps and supporting the same are formed in the frame **40**. Preferably, a notch **33** is formed in a connecting portion between the bumps **31** and the bridge **32**, which is for easily separating the bumps bonded on the lower pattern **24***b* of the substrate **23** from the bridge **32**, as to be described later. As described above, the shapes of the bumps **31** are not limited to cylindrical ones and the only restriction is that the cross-sectional shapes thereof have to be constant. Alternatively, the notch **33** can be formed by performing a secondary etching separately after the primary etching for forming the bumps **31** and the bridge **32**.

To facilitate separation of the bumps **31** and the bridge **32**, in addition to the notch **33**, a fracture portion **34***a* can be formed by half-etching the overall end of the bridge **32**, as shown in FIG. **5**.

Also, as shown in FIGS. **6** and **7**, fracture portions **34***b* and **34***c* may be formed by half-etching the center or edges of the end of the bridge **32**.

Hereinbelow, the method for bonding the bumps **31** on the lower pattern **24***b* of the substrate **23** using the frame **40** formed with bumps **31** will be described.

The frame **40** having the bumps **31** is submerged in a coating basin **51** containing liquid solder S to then be coated therewith, as shown in FIG. **8**. When the liquid solder S is coated on both the bumps **31** and the bridge **32**, the liquid solder S coated on the bridge **32** conglomerates by surface tension so that the liquid solder S coated on the bumps **31** does not become uniform. To solve such a problem, only the bumps **31** exclusive of the bridge **32** are submerged in the liquid solder S so that the liquid solder S is coated on only parts of the bumps **31**.

Then, the frame **40** in which the liquid solder S is coated on the bumps **31** is Maligned on the lower surface of the substrate **23**, as shown in FIG. **9**, so that the bumps **31** are positioned on the lower pattern **24***b*. The alignment of the frame **40** with respect to the substrate **23** can be achieved by coupling the guide slot **40***a* and guide hole **40***b* formed in the frame **40** to an alignment member (not shown).

If the alignment of the frame **40** on the substrate **23** is completed, soldering is performed at a high temperature for the bumps **31** to be bonded on the lower pattern **24***b*.

Next, if the bumps **31** are completely bonded on the pattern **24***b*, the notch (**33** of FIG. **4**) or the fracture portion (**34***a* of FIG. **5**) is broken, thereby separating the bumps **31** from the bridge **32**. In such a manner, the bridge **32** and the frame **40** can be removed.

According to the semiconductor package of the present invention and the manufacturing method therefor, a plurality of bumps can be simultaneously bonded on a pattern using a frame in which the plurality of bumps are connected by a bridge. Also, the frame can be easily aligned with respect to a substrate and the bumps are bonded by soldering while being supported to the frame, misalignment of the bumps or missing bumps are not produced. Therefore, the manufacturing process becomes simplified, defective proportion is reduced, and reliability of the semiconductor package is increased.

What is claimed is:

1. A method for manufacturing a semiconductor package comprising the steps of:

(a) forming a metal frame having a bridge connected to a plurality of bumps such that each of the bumps is supported by the metal frame;

(b) coating liquid solder on the bumps;

(c) aligning the frame with respect to a semiconductor substrate where patterns are formed so that the bumps are positioned on the patterns;

(d) soldering the bumps on the patterns; and

(e) separating the bumps from the frame by breaking a connecting portion from the bridge.

2. The method according to claim **1**, wherein the step (a) comprises the steps of:

coating a photosensitive material on the metal frame;

exposing the metal frame using a mask where patterns corresponding to the bumps and the bridge are formed;

developing the metal frame; and

etching the metal frame to form the bumps and the bridge.

3. The method according to claim **1**, further comprising the step of forming a notch at an end of the bridge connected to the bumps.

4. The method according to claim **1**, further comprising the step of half-etching the end of the bridge to form fracture portions at the end of the bridge connected to the bumps.

5. The method according to claim **1**, wherein in the step (b), the liquid solder is coated on only a part of the bumps.

* * * * *