Description

BACKGROUND OF THE INVENTION

This invention relates to a semiconductor device, and more particularly to a semiconductor device of plastic mold type using a bedless lead frame.

Because plastic mold type semiconductor devices are easy to mass-produce and can be manufactured at a low cost, they have been widely used in recent years. Such semiconductor devices have been used also in large semiconductor devices having many pins over 100 pins.

In conventional plastic mold type semiconductor devices, a lead frame having a bed portion for mounting a pellet is ordinarily used. However, the problems which occur in using the conventional lead frame are as follows: First is that tie bars for fixing the bed portion to the outer frame hinder the arrangement of the inner leads, resulting in a lowered area efficiency. Second is that the tie bars serve as a route for moisture to penetrate from the outside. Third is that a crack due to the difference between the coefficient of thermal expansion of the bed portion and that of the plastic resin for mold is likely to occur. Fourth is the troublesome design and the poor economic efficiency because the dimensions of the bed portion must be changed in conformity with the dimensions of the pellet used.

To overcome such problems, a bedless semiconductor device has been proposed. FIG. 1 shows a cross section of the bedless semiconductor device, wherein leads 15 extend closer to the vicinity of the center of the semiconductor device, when compared to those of the conventional one, and no bed portion is provided. An insulating sheet (tape) 16 is fixed onto substantially the central portion of the semiconductor device in a manner where it is supported by the leads 15. After a pellet 12 is subjected to die-bonding so that it is mounted on the insulating sheet 16, wire-bonding is implemented to connect the pellet 12 and the leads 15 by means of wires 13.

FIGS. 2A, 2B and 2C show how mounting using such bedless type lead frames are conducted. In FIG. 2B, a small pellet 12 is mounted on the central portion of the lead frame 20 shown in FIG. 2A through a small insulating sheet 16. On the other hand, in FIG. 2C, a pellet 12' larger than that in the case of FIG. 2B, is mounted on the same portion as the above through a large insulating sheet 16'.

FIG. 3 is a plan view in which the central portion of the bedless type lead frame shown in FIG. 2A is enlarged. A configuration is provided such that tip portions of respective inner leads 15a are substantially equidistant from the center of the lead frame.

A similar bedless type lead frame is also described in the Nikkei Microdevices, December 1, 1987, Nikkei McGraw-Hill, pp. 76-78 and the Nikkei Electronics, November 16, 1987, Nikkei McGraw-Hill, pp. 100-101.

When such a bedless type lead frame is employed, mounting of pellets of different sizes is enabled by using the same kind of lead frames. Thus, productive management is facilitated and costs can be reduced.

However, because a large number of inner leads are all directed toward the center of the lead frame as shown in FIG. 3 in the conventional bedless type lead frame, the tip portion of each inner lead becomes extremely thin, so that the ability to support the insulating sheet at the central portions of the lead frame is extremely reduced, leading to the problems that a stable support becomes impossible.

The Japanese patent JP-A-60-84854 describes a resin-sealed semiconductor device according to the preambles of claims 1 and 3, in which device a semiconductor pellet is mounted on a flexible insulating film of polyimide resin. An insulating frame is provided of silicon rubber and leads are fixed on the film outside the frame. The ends of the leads are connected to the internal terminals on the chip surface by bonding wires.

JP-A-59-129 451 describes a lead frame in which every other lead of the inner leads is bent to form a multi-layered structure in the congested area close to the chip terminals. The broadened inner lead tip portions of those leads which are not bent are positioned closer to the centre of the lead frame than the tip portions of the bent inner leads.

SUMMARY OF THE INVENTION

Therefore, an object of this invention is to provide a semiconductor device capable of stably supporting an insulating sheet even at the central portion of a bedless lead frame.

In accordance with this invention, there is provided a semiconductor device comprising a bedless lead frame having a plurality of inner leads substantially radially arranged around a pellet mounting area of said lead frame, further comprising an insulating sheet arranged on said pellet mounting area so as to adhesively fix tip portions of said inner leads and a semiconductor pellet mounted on said insulating sheet, **characterized in that** each tip portion of at least every other inner lead is provided with a broader portion which is broader than the width of each of other inner lead tip portions, that each of said broader portions is positioned closer to the centre of the lead frame than said other inner lead tip portions and that an

opening is provided within each of said broader portions, a bonding material used in bonding the insulating sheet being inserted into the openings.

The object of the invention is also solved by a semiconductor device comprising a bedless lead frame having a plurality of inner leads substantially radially arranged around a pellet mounting area of said lead frame, further comprising an insulating sheet arranged on said pellet mounting area so as to adhesively fix tip portions of said inner leads and a semiconductor pellet mounted on said insulating sheet, **characterized in that** each tip portion of at least every other inner lead is provided with a broader portion which is broader than the width of each of other inner lead tip portions, that each of said broader portions is positioned closer to the centre of the lead frame than said other inner lead tip portions and that a thin portion is provided within said broader portions, which thin portions are formed so as to improve the bonding strength of the insulating sheet.

Since the inner lead tip portions of the lead frame are formed broader at least at every other inner lead and since an opening or a thin portion for improving adhesive property of the insulating sheet is provided in each broader portion, the broader portion increases the contact surface to the insulating sheet, and the opening or the thin portion improves the bonding strength. Accordingly, even when a large number of inner leads are provided, it is possible to stably and firmly support the insulating sheet. In addition, since many kinds of semiconductor devices can be manufactured using the same lead frame in accordance with this invention, economical efficiency is also improved.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is a cross sectional view showing the structure of a semiconductor device using a conventional bedless type lead frame;

FIGS. 2A to 2C are plan views showing how pellets of different sizes are mounted using bedless type lead frames;

FIG. 3 is a plan view showing the central portion of a conventional bedless type lead frame;

FIG. 4 is an enlarged plan view of the central portion of a lead frame used in a semiconductor device according to this invention;

FIG. 5 is an enlarged plan view of the inner lead tip portions shown in FIG. 4;

FIGS. 6A to 6C are cross sectional views showing the structure for increasing the bonding strength provided on the inner lead tip portion; and

FIG. 7 is a graph showing the effect of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Several embodiments according to this invention will be described in detail with reference to the drawings.

FIG. 4 is an enlarged plan view showing a portion of a lead frame used for a semiconductor device according to an embodiment of this invention.

In accordance with this figure, in the same manner as in the conventional semiconductor device using a bedless leadframe, inner leads 1 extend up to the portion in the vicinity of the central portion of the semiconductor device, and no bed portion is provided. Inner leads 1 under the insulating sheet 3 on which the pellet 2 is mounted as indicated by single-dotted lines are constructed as understood from FIG. 5 which is a plan view having an expansion rate greater than that of FIG. 4 in a manner that, e.g., the tip portion 1a of one inner lead and the tip portion 1b of the adjacent inner lead are different in the width and the position, i.e., the tip portion 1a is broader than the tip portion 1b and is positioned closer to the central portion of the lead frame than the latter. In addition, a circular opening 1c is provided in the broader tip portion 1a. The cross section of the opening 1c is shown in FIG. 6A.

By employing such a configuration, when an insulating sheet is mounted on the lead frame, the broader portion 1a supports the insulating sheet at a position closer to the center of the lead frame and over a broad area, and bonding material is inserted into the opening 1c in bonding the insulating sheet, thus improving the bonding strength of the insulating sheet.

It is to be noted that it is required for such an insulating sheet to have a heat resistance property to tolerate temperatures of 160 to 180 °C for 1 to 5 minutes which is the heat condition at the time of plastic molding, as well as to have an excellent moisture resisting property, and to also have a coefficient of thermal expansion after plastic-molding, which is approximate to those of the inner leads and the pellet. Polyimide resin sheet is ordinarily used as the material satisfying these conditions. For the other material, a paper into which thermosetting resin such as epoxy resin is impregnated may be also used.

For a method for improving the bonding strength of the insulating sheet, as shown in FIG. 6B, half-etching using an etchant may be also implemented to form a thin portion 1d.

FIG. 7 is a graph showing the effect obtained with this invention using a flat package of 44 pins wherein curve A shows the friction strength of the insulating sheet in the case of using a conventional

lead frame, curve B shows the stripping strength of the insulating sheet in the case of using a lead frame having a tip formed as shown in FIG. 4 and including no opening, and curve C shows the stripping strength in the case of a lead frame having an opening shown in FIG. 6A. From this graph, it is seen that the bonding strength is considerably increased by the implementation of this invention.

While a single opening in FIG. 6A or a single half-etching portion in FIG. 6B is provided in the inner lead in the above-described embodiment, it may be provided in each lead. FIG. 6C shows the example where two half-etching portions 1d are provided in one lead.

Claims

1. A semiconductor device comprising a bedless lead frame having a plurality of inner leads (1) substantially radially arranged around a pellet mounting area of said lead frame, further comprising an insulating sheet (3) arranged on said pellet mounting area so as to adhesively fix tip portions of said inner leads (1) and a semiconductor pellet (2) mounted on said insulating sheet (3), **characterized in that** each tip portion of at least every other inner lead (1) is provided with a broader portion (1a) which is broader than the width of each of other inner lead tip portions (1b), that each of said broader portions (1a) is positioned closer to the centre of the lead frame than said other inner lead tip portions (1b) and that an opening (1c) is provided within each of said broader portions (1a), a bonding material used in bonding the insulating sheet (3) being inserted into the openings (1c).

2. A semiconductor device as set forth in claim 1, wherein said insulating sheet consists of polyimide.

3. A semiconductor device comprising a bedless lead frame having a plurality of inner leads (1) substantially radially arranged around a pellet mounting area of said lead frame, further comprising an insulating sheet (3) arranged on said pellet mounting area so as to adhesively fix tip portions of said inner leads (1) and a semiconductor pellet (2) mounted on said insulating sheet (3), **characterized in that** each tip portion of at least every other inner lead (1) is provided with a broader portion (1a) which is broader than the width of each of other inner lead tip portions (1b), that each of said broader portions (1a) is positioned closer to the centre of the lead frame than said other inner lead tip portions (1b) and that a thin portion (1d) is provided within said broader portions (1a), which thin portions (1d) are formed so as to improve the bonding strength of the insulating sheet (3).

4. A semiconductor device as set forth in claim 3, wherein said insulating sheet consists of polyimide.

Revendications

1. Un dispositif semi-conducteur comportant un cadre de montage de conducteurs sans partie servant d'embase ayant une pluralité de conducteurs internes 1 disposés de manière substantiellement radiale autour d'une zone de montage d'une puce dudit cadre de montage de conducteurs, comprenant en outre une feuille isolante 3 placée sur ladite zone de montage de la puce de façon à fixer par adhérence les parties formant les extrémités desdits conducteurs internes 1 et une puce en semiconducteur 2 montée sur ladite feuille isolante 3, ledit dispositif étant caractérisé par le fait que chaque partie constituant l'extrémité d'un conducteur intérieur sur deux 1 comporte une partie élargie 1a dont la largeur est supérieure à la largeur de la partie constituant l'extrémité 1b de chacun des autres conducteurs intérieurs, et par le fait que chacune desdites parties élargies 1a occupe une position plus proche du centre du cadre de montage que lesdites parties constituant les extrémités 1b des autres conducteurs et par le fait qu'un orifice 1c est pratiqué dans chacune desdites parties élargies 1a, et par le fait qu'un matériau de soudage utilisé pour souder la feuille isolante 3 est inséré dans les orifices 1c.

2. Un dispositif en semi-conducteur selon la revendication 1, dans lequel ladite feuille isolante est en polyimide.

3. Un dispositif en semi-conducteur comprenant un cadre de montage des conducteurs sans partie servant d'embase ayant une pluralité de conducteurs internes 1 disposés substantiellement de manière radiale tout autour de la zone de montage de la puce sur ledit cadre de montage des conducteurs , comprenant en outre une feuille isolante 3 placée sur ladite zone de montage de la puce de manière à fixer par adhérence les parties constituant les extrémités desdits conducteurs internes 1 et une puce en matériau semi-conducteur 2 montée sur ladite feuille isolante 3, ledit dispositif étant caractérisé par le fait que chacune des parties

lead frame, curve B shows the stripping strength of the insulating sheet in the case of using a lead frame having a tip formed as shown in FIG. 4 and including no opening, and curve C shows the stripping strength in the case of a lead frame having an opening shown in FIG. 6A. From this graph, it is seen that the bonding strength is considerably increased by the implementation of this invention.

While a single opening in FIG. 6A or a single half-etching portion in FIG. 6B is provided in the inner lead in the above-described embodiment, it may be provided in each lead. FIG. 6C shows the example where two half-etching portions 1d are provided in one lead.

Claims

1. A semiconductor device comprising a bedless lead frame having a plurality of inner leads (1) substantially radially arranged around a pellet mounting area of said lead frame, further comprising an insulating sheet (3) arranged on said pellet mounting area so as to adhesively fix tip portions of said inner leads (1) and a semiconductor pellet (2) mounted on said insulating sheet (3), **characterized in that** each tip portion of at least every other inner lead (1) is provided with a broader portion (1a) which is broader than the width of each of other inner lead tip portions (1b), that each of said broader portions (1a) is positioned closer to the centre of the lead frame than said other inner lead tip portions (1b) and that an opening (1c) is provided within each of said broader portions (1a), a bonding material used in bonding the insulating sheet (3) being inserted into the openings (1c).

2. A semiconductor device as set forth in claim 1, wherein said insulating sheet consists of polyimide.

3. A semiconductor device comprising a bedless lead frame having a plurality of inner leads (1) substantially radially arranged around a pellet mounting area of said lead frame, further comprising an insulating sheet (3) arranged on said pellet mounting area so as to adhesively fix tip portions of said inner leads (1) and a semiconductor pellet (2) mounted on said insulating sheet (3), **characterized in that** each tip portion of at least every other inner lead (1) is provided with a broader portion (1a) which is broader than the width of each of other inner lead tip portions (1b), that each of said broader portions (1a) is positioned closer to the centre of the lead frame than said other inner lead tip portions (1b) and that a thin portion (1d) is provided within said broader portions (1a), which thin portions (1d) are formed so as to improve the bonding strength of the insulating sheet (3).

4. A semiconductor device as set forth in claim 3, wherein said insulating sheet consists of polyimide.

Revendications

1. Un dispositif semi-conducteur comportant un cadre de montage de conducteurs sans partie servant d'embase ayant une pluralité de conducteurs internes 1 disposés de manière substantiellement radiale autour d'une zone de montage d'une puce dudit cadre de montage de conducteurs, comprenant en outre une feuille isolante 3 placée sur ladite zone de montage de la puce de façon à fixer par adhérence les parties formant les extrémités desdits conducteurs internes 1 et une puce en semiconducteur 2 montée sur ladite feuille isolante 3, ledit dispositif étant caractérisé par le fait que chaque partie constituant l'extrémité d'un conducteur intérieur sur deux 1 comporte une partie élargie la dont la largeur est supérieure à la largeur de la partie constituant l'extrémité 1b de chacun des autres conducteurs intérieurs, et par le fait que chacune desdites parties élargies la occupe une position plus proche du centre du cadre de montage que lesdites parties constituant les extrémités 1b des autres conducteurs et par le fait qu'un orifice 1c est pratiqué dans chacune desdites parties élargies 1a, et par le fait qu'un matériau de soudage utilisé pour souder la feuille isolante 3 est inséré dans les orifices 1c.

2. Un dispositif en semi-conducteur selon la revendication 1, dans lequel ladite feuille isolante est en polyimide.

3. Un dispositif en semi-conducteur comprenant un cadre de montage des conducteurs sans partie servant d'embase ayant une pluralité de conducteurs internes 1 disposés substantiellement de manière radiale tout autour de la zone de montage de la puce sur ledit cadre de montage des conducteurs , comprenant en outre une feuille isolante 3 placée sur ladite zone de montage de la puce de manière à fixer par adhérence les parties constituant les extrémités desdits conducteurs internes 1 et une puce en matériau semi-conducteur 2 montée sur ladite feuille isolante 3, ledit dispositif étant caractérisé par le fait que chacune des parties

constituant l'extrémité d'au moins un conducteur interne 1 sur deux comporte une partie élargie 1a dont la largeur est supérieure à la largeur de chacune des autres parties constituant les extrémités 1b des autres conducteurs internes, et par le fait que chacune desdites parties élargies 1a occupe une place plus proche du centre du cadre de montage des conducteurs que ladite autre partie constituant l'extrémité 1b de chacun des autres conducteurs internes, et par le fait qu'une fine partie 1d est pratiquée dans chacune desdites parties élargies 1a, lesquelles dites parties fines 1d ont pour fonction d'améliorer la résistance de liaison de la feuille isolante 3.

4. un dispositif en semi-conducteur selon la revendication 3 dans lequel ladite feuille isolante est en polyimide.

Patentansprüche

1. Halbleitervorrichtung, umfassend einen bettfreien Leitungsrahmen mit einer Vielzahl von inneren Leitungen (1), die im wesentlichen radial um ein Pellet-Anbringungsgebiet des Leitungsrahmens angeordnet sind, außerdem umfassend eine isolierende Schicht (3), die auf dem Pellet-Anbringungsgebiet so angebracht ist, um Endabschnitte der inneren Leitungen (1) und ein auf der isolierenden Schicht (3) angebrachtes Halbleiter-Pellet (2) klebend zu befestigen,
dadurch **gekennzeichnet,** daß jeder Abschnitt von wenigstens jeder anderen Leitung (1) mit einem breiteren Abschnitt (1a) versehen ist, der breiter ist als die Breite von jedem anderen inneren Leitungsendabschnitt (1b), daß jeder der breiteren Abschnitte (1a) näher zur Mitte des Leitungsrahmens als der andere innere Leitungsendabschnitt (1b) angeordnet ist, und daß eine Öffnung (1c) innerhalb jedes breiteren Abschnittes (1a) vorgesehen ist, wobei ein beim Bonden der isolierenden Schicht (3) verwendetes Bondierungsmaterial in die Öffnungen 1c eingefügt ist.

2. Halbleitervorrichtung nach Anspruch 1,
dadurch **gekennzeichnet,** daß die isolierende Schicht aus Polyimid besteht.

3. Halbleitervorrichtung umfassend einen bettfreien Leitungsrahmen mit einer Vielzahl von inneren Leitungen (1), die im wesentlichen radial um ein Pellet-Anbringungsgebiet des Leitungsrahmens angeordnet sind, außerdem umfassend eine isolierende Schicht (3), die auf dem Pellet-Anbringungsgebiet so angeordnet ist, um Endabschnitte der inneren Leitungen (1) und ein auf der isolierenden Schicht (3) angebrachtes Halbleiter-Pellet (2) klebend zu befestigen,
dadurch **gekennzeichnet,** daß jeder Endabschnitt von wenigstens jeder anderen inneren Leitung mit einem breiteren Abschnitt (1a) versehen ist, der breiter ist als die Breite von jedem anderen inneren Leitungsendabschnit (1b), daß jede der inneren breiteren Abschnitte (1a) näher zur Mitte des Leitungsrahmens als die anderen innerern Leitungsendabschnitte (1b) angeordnet ist, und daß ein dünner Abschnitt (1d) innerhalb der breiteren Abschnitte (1a) vorgesehen ist, wobei die dünneren Abschnitte (1d) so gebildet sind, um die Bondierungsstärke der isolierenden Schicht (3) zu verbessern.

4. Halbleitervorrichtung nach Anspruch 3,
dadurch **gekennzeichnet,** daß die isolierende Schicht aus Polyimid besteht.