

SEMICONDUCTOR DEVICE HOUSING TRAY

Field of the Invention:

The invention relates to a semiconductor device housing tray, particularly relates to a semiconductor device housing tray made of conductive plastics and formed by injection molding.

Description of the related art:

A semiconductor device has been recently developed in downsizing due to high integration, and it is now shifting from a pin grid array (hereinafter referred to as PGA) type to a ball grid array (hereinafter referred to as BGA) type and further to a land grid array (hereinafter referred to as LGA) type.

A dedicated housing tray (hereinafter referred to as tray) is employed for stocking or transferring these semiconductor devices. This tray is used for not only protecting the semiconductor device when it is handled, but also for handling it easily and particularly when it is set thereon manually or automatically.

It is required, in manufacturing the tray, to quickly respond to follow a developing speed of the semiconductor device, and to reduce a manufacturing cost, and to shorten the time for delivering the semiconductor device to customers.

Many trays for housing the foregoing PGA type, BGA type and LGA type semiconductor devices are developed to be suitable for shapes of the semiconductor devices which are disclosed in Japanese Patent Laid Open Publication No. 2-45381, Patent No. 2,852,872, and so on. However, most of these trays are partitioned in a lattice shape in whole for arranging many semiconductor devices thereon which are typically represented by Figs. 11 and 12 wherein the entire tray is not illustrated but one partition of the tray for housing one semiconductor device of many arranged semiconductor devices is illustrated.

Fig. 11(a) is a plan view showing one partition of a tray for housing a BGA type semiconductor device, and Fig. 11(b) is a sectional view taken along the line M-N-M-N in Fig. 11(a), and Fig. 12(b) is a sectional view

taken along the line O-P-O-P in Fig. 11(a); and Fig. 12(b) is a bottom view of Fig. 11(a).

The tray is rectangular in whole and there are formed supporting portions 101, 102 inside a frame body (not shown) formed along an external shape thereof in vertical and lateral directions such that beams are arranged in a lattice shape. An opened pocket 103 is formed by the supporting portions 101, 102. Flat shaped ribs 101a, 102a are formed on the back sides of the supporting portions 101, 102 so as to be hung therefrom. With the semiconductor device 105, an outer peripheral portions of a base portion 105a of a semiconductor device semiconductor device 105 is supported by flat supporting surfaces 101b, 102b on the surfaces formed on the supporting portions 101, 102 along the peripheral edges of the pocket 103.

Further, as shown in Fig. 11(b), supporting portions 101c, 102c are formed on the ribs 101a, 102a which are formed on the back sides of the supporting portions 101, 102, and supporting surfaces 101d, 102d comprising an inclined surface and a flat surface formed on the tip ends of the supporting portions 101c, 102c can also support the semiconductor device 105. The supporting surfaces 101d, 102d support the semiconductor device 105 when the trays are turned upside down while they are piled up, more in detail the outer peripheral portion of a sealed resin portion 105b thereof.

The semiconductor device 105 is placed on and housed in the front side of the tray, i.e., the supporting surfaces 101b, 102b, and it is stocked and transferred in a state where another tray is piled up thereon while the semiconductor device 105 is housed therein.

Meanwhile, the semiconductor device 105 undergoes operations such as a test at the front and back sides thereof while it is placed on the tray. When the front side of the semiconductor device 105 is tested, the tray is supplied to a testing step while keeping the position thereof, namely, the front side thereof remains directed upward. On the other hand, when the back side of the semiconductor device 105 is tested, all groups of trays which are piled up while the front sides thereof remain directed upward are turned upside down at the same time so that the semiconductor device 105 supported on the trays are to be supported by the supporting surfaces 101d, 102d formed on the back side of the trays

positioned downward as shown in Fig. 11(b).

When using the foregoing tray, the semiconductor device 105 can be easily stocked, transferred, and various operations for the semiconductor device 105 can be easily performed. However, since the tray has a variety of ribs in addition to the lattice-shaped supporting portions 101, 102 for supporting the semiconductor device 105 on these beam-like supporting portions and the ribs, precise molding is required. However, a mold for manufacturing the tray requires an expensive electric discharge machining, which makes it difficult to reduce a manufacturing cost.

Further, the tray having the foregoing shape has the problem in that it is difficult to render the thickness uniform in whole, and warpage, shrinkage cavity are liable to occur therein, and there occurs a shortage that molten resin does not extend completely to minute ribs.

Further, since the outer peripheral portion of the base portion 105a is supported when the front side of the semiconductor device 105 is tested, while the outer peripheral portion of the sealed resin portion 105b is supported when the back side of the semiconductor device 105 is tested, there is a possibility that the position of the semiconductor device 105 is differentiated at the front and back sides thereof. More in detail, the positions of the semiconductor devices when the front and back sides thereof are tested are not fixed, causing problems that the positions of the semiconductor devices are differentiated at the front and back sides, and the positions of the semiconductor devices are changed when the semiconductor devices are transferred by turning the trays upside down. The smaller the size of the semiconductor device to be handled, the more frequently the problem occurs.

Considering a case where plural kinds of semiconductor devices each having the same external appearance are handled, the foregoing tray can handle the semiconductor devices if a portion where balls are arranged is housed in the tray pocket 103 but can not handle the semiconductor devices if the portion where the balls are arranged is not housed in the tray pocket 103. Further, when the tray is turned upside down to support the semiconductor device, the outer periphery of the sealed resin 105b is supported, which causes a problem that the kind of semiconductor device to be handled is limited depending on the shape of

the sealed resin portion.

SUMMARY OF THE INVENTION

Example embodiments may provide a semiconductor device housing tray which can be manufactured with a simple construction, can prevent deformation such a warpage, and which is suitable for testing the front and back sides of the semiconductor device, and can handle variety of semiconductor devices, thereby enhancing a general purpose.

In a first aspect of the present invention, there is provided a semiconductor device housing tray for arranging and containing flat type semiconductor devices therein comprising a plurality of substantially columnar protrusions provided on a supporting surface thereof for supporting the semiconductor devices on the front side thereof, said protrusions contacting the side surfaces of the semiconductor devices for restricting swing motion of the semiconductor devices.

The semiconductor device housing tray may further comprise a plurality of substantially columnar protrusions provided on a supporting surface thereof formed on the back side of the tray for supporting the semiconductor devices thereon, said protrusions contacting the side surfaces of the semiconductor devices for restricting swing motion of the semiconductor devices, wherein the protrusions provided on the front side thereof and the protrusions provided on the back side thereof are got out of position at an angular position with respect of the centers of the supporting surfaces thereof by a given angle.

The supporting portion may have the supporting surface provided on the front side thereof is plate-like, and the supporting surface

provided on the back side thereof is formed on the tip ends of frame-like ribs protruded integrally with the backside of the plate-like supporting portion.

The protrusions provided on the back side thereof may be lined up along the peripheral surfaces of the semiconductor device to surround the semiconductor device together with the protrusions provided on the front side thereof, and tip ends of the protrusions provided on the back side extend to the supporting region provided on the front side thereof when a plurality of trays are piled up.

The protrusions provided on both the front and back side thereof may be substantially conical and the tip ends thereof are spherical.

The plate-like ribs may be integrally provided between the frame-like ribs.

Openings may be defined in a portion other than the supporting surface of the plate-like supporting portion.

Also disclosed is that, respective protrusions may be positioned to surround the side surfaces of the semiconductor device and position the semiconductor device on the supporting surface thereof.

Further, the supporting surface provided on the back side of the tray may be provided in a state where the angular position about the supporting surface with respect to the protrusions provided on the front side is turned, e. g., 90 °, wherein the protrusions provided on the front and back sides thereof are rendered adjoined with one another without interfering with one another in a state where the trays are piled up. When a test is performed for the front and back sides of the semiconductor device, the position of the semiconductor device is maintained steady and the test for the front and back sides can be performed without any trouble.

More in detail, the supporting portion having the supporting surface on the front side of the tray may be plate-like, and the frame-like ribs are protruded from and integrally formed on the back side of the plate-like supporting portion, wherein the supporting surface on the back

side of the tray may be formed on the tip ends of the frame-like ribs formed on the back side of the plate-like supporting surface so that the tray are substantially composed of the plate-like supporting portions, frame-like ribs, and the columnar protrusions, thereby making the construction simple.

Still further, other protrusions formed on the back side of the tray may be lined up along the side surfaces of the semiconductor devices together with the protrusions formed on the front side of the tray to surround the semiconductor devices when the trays are piled up, and the tip ends may extend the supporting surface regions provided on the front side of the tray so that when the semiconductor devices are transferred onto the new tray positioned underneath by turning the piled up trays upside down in the case of testing the back sides of the semiconductor devices, the semiconductor devices may be transferred as they are without getting out of position between the semiconductor devices.

Still further, since respective protrusions provided on the front and back sides of the tray may be formed conical, the tip ends may be formed spherical or flat frustoconical, the semiconductor devices can be smoothly guided to given positions of the tray when they are placed thereon. The shape of the protrusion as viewed from the top thereof may be triangular or formed in a star.

In addition to the foregoing, plate-like ribs may be provided between the frame-like ribs on the back side of the tray to serve as reinforcing members, thereby enhancing rigidity of the tray in whole.

Still further, openings may be defined in the portion other than the supporting surface of the plate-like supporting portion, thereby lightening the tray so that the tray may be easily handled when transferring the semiconductor devices.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is a view showing a semiconductor device housing tray according to the invention, wherein Fig. 1(a) is a plan view, Fig. 1(b) is a left side view and Fig. 1 (c) is a front view;

Fig. 2 is a bottom view of the semiconductor device housing tray shown in Fig. 1

Fig. 3 is an enlarged view of the semiconductor device housing

tray at the portion of A-1 in Fig. 1;

Fig. 4 is a sectional view taken along the line B-B in Fig. 3;

Fig. 5 is a sectional view taken along the line C-C in Fig. 3;

Fig. 6 is an enlarged view of the semiconductor device housing tray at the portions of D- 1 in Figs. 1 and 3;

Fig. 7 is an enlarged view of the semiconductor device housing tray at the portion of D- 2 in Fig. 2;

Fig. 8 is a sectional view taken along the line E-E in Figs. 6 and 7;

Fig. 9 is a sectional view taken along the line F-F in Figs. 6 and 7;

Fig. 10 is an enlarged view of the semiconductor device housing tray at the portion of G in Fig. 8;

Fig. 11 is a view showing one partition for housing a semiconductor device in a conventional semiconductor device housing tray, Fig. 11 (a) is a plan view, and Fig. 11(b) is a sectional view taking along the line M-N-M-N in Fig. 11(a); and

Fig. 12(b) is a sectional view taking along the line O-P-O-P in Fig. 11(a), and Fig. 12(b) is a bottom view of Fig. 11(a).

PREFERRED EMBODIMENTS OF THE INVENTION

A preferred embodiment of the invention is now described with reference to the attached drawings.

Figs. 1(a), 1(b) and 1(c) show respectively a plan view, a left side view and a front view of a semiconductor device housing tray (hereinafter referred to as simply as a tray) 1 of the invention, and Fig. 2 is a bottom view in Fig. 1.

The tray 1 is made of a conductive plastic and formed by injection molding, and comprises a rectangular frame body 2 formed in a rectangular shape in whole and a supporting portion 3 extending to an entire inner region of the frame body 2. The entire surface of the supporting portion 3 is partitioned or divided into 30 parts in a vertical direction and into 12 parts in a horizontal wherein each divided part has a substantially same area on which each semiconductor device is supported, and hence the tray 1 can arrange and house therein 366 pieces of semiconductor devices in total. Inasmuch as a state where the semiconductor device is supported on each partitioned part is the same, several partitioned parts are described in detail next.

Fig. 3 is an enlarged view of the semiconductor device housing tray at the portion of A-1 in Fig. 1, Figs. 4 and 5 are sectional views taken along lines B-B and C-C in Fig. 3, Fig. 6 is an enlarged view of the semiconductor device housing tray at the portions of D-1 in Fig. 3, and Fig. 7 is a rear view in Fig. 6, namely, an enlarged view of the bottom of the semiconductor device housing tray 1 in Fig. 2.

In Fig. 3 showing one of four corners of the tray 1, depicted by 3 shows a supporting portion at the front side of the tray 1, 3a is a supporting surface for supporting a semiconductor device 5 which is surrounded by protrusions 7 having given numbers protruded from the supporting portion 3. Depicted by 3e is cut-off portions, i.e. openings 3e arranged on the supporting portion 3 of the tray 1 in a horizontal direction which contributes for rendering the weight of the tray 1 light in total.

The semiconductor device 5 to be housed in the tray 1 is a BGA type having a substantially square in an external shape but an LGA type semiconductor device can be housed in and supported by the tray 1. As shown in Figs. 3 to 6, one semiconductor device 5 is placed on one partitioned supporting surface 3a of the supporting portion 3. However, the BGA type semiconductor device 5 is placed on the supporting portion 3 while balls (terminals) thereof are directed downward. That is, the supporting portion 3 supports the entire lower surface of the semiconductor device 5.

A plurality of (6 pieces in the embodiment) protrusions 7 are integrally formed with each semiconductor device 5 so as to contact the side surfaces thereof. Each protrusion 7 has the same shape and dimensions such that the height thereof is higher than the thickness of the semiconductor device 5 but not exceeding the depth of the supporting portion of the tray 1. Although the arrangement of the protrusions 7 may be arbitrarily, they are arranged such that 1 piece of the protrusion 7 is arranged respectively on the pair of opposed sides of a substantially square shaped arrangement while 2 pieces of the protrusions 7 are arranged respectively on the other pair of opposed sides thereof.

Each of the protrusions 7 is conical and the tip end thereof is spherical. The shape of each of the protrusions 7 formed on the back side of the tray 1, described later, is the same as that formed on the front

side thereof. Since the protrusions 7 are conical, the semiconductor device 5 is inserted into a space surrounded by the protrusions 7, and passed through the inclined surface thereof and finally guided to a given position of the supporting surface 3a. The shape of the tip end of the protrusion 7 can be rendered frustoconical, and it may be triangular, in a star as viewed from the top, from which any shape can be selected.

On the other hand, as shown in Figs. 4, 5 and 7, the supporting surface 3b are provided on the back side of the tray 1 for supporting the semiconductor device 5 and positioned just opposite to the supporting surface 3a provided on the front surface of the tray 1. The supporting surface 3b are formed on the tip ends of the frame-like ribs 3c by protruding from the back surface of the supporting portion 3. Other 6 pieces of protrusions 8 are arranged along the side surfaces of the semiconductor device 5 such that 1 piece thereof is arranged respectively on the pair of opposed sides of a substantially square shaped arrangement while 2 pieces of the protrusions 7 are arranged respectively on the other pair of opposed sides thereof wherein the protrusions 8 do not interfere with the protrusions 7 provided on the front side of the tray 1.

A test and so forth for the semiconductor device 5 is performed not only at the front side thereof but also at the back side thereof. The test and so forth for the semiconductor device 5 at the front side is performed in a state where it is placed on the supporting surface 3a of the tray 1. On the other hand, the test for the semiconductor device 5 at the back side is performed in a state where it is transferred to and placed on the supporting surface 3b at the back side thereof because the semiconductor device 5 connecting to the supporting surface 3a is surrounded by the protrusions provided on the back side of another piled up tray 1.

It is sufficient to test the semiconductor device 5 at the front side thereof while the position of the semiconductor device 5 is maintained as it is, i. e., while it is placed on the supporting surface 3a and transferred to a testing process. On the other hand, when testing the semiconductor device 5 at the back side thereof, a plurality of trays each placing the semiconductor devices 5 on the supporting surfaces 3a are piled up, and these trays are turned upside down at a time so that the semiconductor

devices 5 on the supporting surface 3a can be transferred onto the supporting surface 3b.

Whereupon, the protrusions 7 provided on the front side of the tray 1 and the protrusions 8 provided on the back side of another tray 1 are got out of position at an angular position with respect to the centers of the supporting surface 3a and supporting surface 3b by a given angle so that the front side of the tray 1 and the back side of another tray 1 can be piled up while they are not interfered with each other. According to the invention, the arrangement of the protrusions 7 and that of the protrusions 8 are offset by 90 degrees.

Further, as evident from Figs. 6 to 10, the other protrusions 8 provided on the back side of another tray 1 are lined up along the side surfaces of the semiconductor device 5 together with the protrusions 7 to surround the semiconductor device 5 when the trays 1 are piled up vertically, and the tip ends of the protrusions 8 extend the tip regions of the protrusions 7 provided on the front side of the tray 1. As a result, in the case where the semiconductor devices 5 are transferred to a new tray 1 positioned under the tray 1 by turning the piled up trays upside down when testing the back side of the semiconductor device 5, the semiconductor devices 5 can be transferred as they are while they are not got out of position in a horizontal direction.

Accordingly, since the semiconductor devices 5 are transferred while they are housed in a space where they are surrounded by the protrusions 7 and other protrusions 8 in a state where the trays 1 are piled up, they are not come off from the tray 1 so far as the trays 1 are piled up.

Although the foregoing explanation is applied to a case where the semiconductor device 5 has a square shape or a shape close thereto, this is also applied to a case where the semiconductor device 5 is rectangular if the arrangement of the protrusions are changed. In other words, it is sufficient that the trays 1 are arranged such that the protrusions 7 on the front side of the tray 1 and the protrusions 8 on the back side thereof are positioned while they are not interfered with each other when the trays 1 are piled up.

Meanwhile, the tray 1 is reinforced if the plate-like ribs 3d are provided integrally between the frame-like ribs 3c provided on the back

side of the tray 1, thereby increasing the rigidity of the tray 1 in whole.

As is evident from the foregoing explanation, the semiconductor device housing tray according to the invention, a plurality of protrusions which contact the side surfaces of the semiconductor device are provided on the supporting surface thereof for supporting the semiconductor device so as to surround them. More in detail, since the semiconductor device housing tray is structured such that the supporting portion having the supporting surface of the tray is plate-like, and the frame-like ribs are protruded from the back surface of the plate-like supporting portion and the supporting surface are formed on the back of the tray at the tip end surface of the frame-like ribs, it substantially comprises only the plate-like supporting portion, frame-like ribs, and protrusions, and hence a mold for forming a tray by injection molding is simplified, and a cost for manufacturing such a mold can be reduced to a large extent.

Further, since the construction of the tray is simple, the thickness of the tray is prone to be rendered uniform but it is not prone to be deformed.

Still further, when both the front and back sides of the semiconductor devices are tested, there is no difference in a supporting state thereof at the front and back sides thereof, namely, between the semiconductor devices positioned on the supporting surface at the front side of the tray and that positioned on the supporting surface at the back side thereof so that the angular position of the semiconductor devices are fixed, causing no problem in testing the semiconductor devices.

More still further, even if plural kinds of semiconductor devices each having the same external shape are handled, the semiconductor devices are supported by the entire surfaces of the semiconductor device housing tray and side surfaces of the semiconductor devices are positioned by the protrusions thereof. Accordingly, even in the case of e.g., a BGA type semiconductor device, the state of arrangement of the balls (terminals) thereof is not at all influenced when handling it, increasing the kind of semiconductor devices to be handled so that an improved general-purpose semiconductor device housing tray can be provided.

What is claimed is:

1. A semiconductor device housing tray for arranging and containing flat type semiconductor devices therein comprising a plurality of substantially columnar protrusions provided on a supporting surface thereof for supporting the semiconductor devices on the front side thereof, said protrusions contacting the side surfaces of the semiconductor devices for restricting swing motion of the semiconductor devices.

2. The semiconductor device housing tray according to Claim 1, further comprising a plurality of substantially columnar protrusions provided on a supporting surface thereof formed on the back side of the tray for supporting the semiconductor devices thereon, said protrusions contacting the side surfaces of the semiconductor devices for restricting swing motion of the semiconductor devices, wherein the protrusions provided on the front side thereof and the protrusions provided on the back side thereof are got out of position at an angular position with respect of the centers of the supporting surfaces thereof by a given angle.

3. The semiconductor device housing tray according to Claim 1 or 2, wherein the supporting portion having the supporting surface provided on the front side thereof is plate-like, and the supporting surface provided on the back side thereof is formed on the tip ends of frame-like ribs protruded integrally with the backside of the plate-like supporting portion.

4. The semiconductor device housing tray according to Claim tray 1, 2, or 3 wherein the protrusions provided on the back side thereof are lined up along the peripheral surfaces of the semiconductor device to surround the semiconductor device together with the protrusions provided on the front side thereof, and tip ends of the protrusions provided on the back side extend to the supporting region provided on the front side thereof when a plurality of trays are piled up.

5. The semiconductor device housing tray according to Claim 1, 2, 3 or 4, wherein the protrusions provided on both the front and back side thereof are substantially conical and the tip ends thereof are spherical.

6. The semiconductor device housing tray according to Claim 1, 2, 3, line 4 or 5, wherein the plate-like ribs are integrally provided between the frame-like ribs.

7. The semiconductor device housing tray according to Claim 1, 2, 3, 4, 5 or 6, wherein openings are defined in a portion other than the

supporting surface of the plate-like supporting portion.