BARE DIE TRAY CLIP

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] This application is related to U.S. Patent Application entitled "Open Frame Tray Clip" [Attorney Docket No. 67810-0304489] filed the same day as this application, and which is expressly incorporated by reference herein.

[0002] This invention relates generally to apparatus for securing trays that are used in storing or transporting components such as semiconductors, and more particularly to a clip for securing a tray and cover or stack of trays and a cover that places stack compression forces on tray perimeter rails in order to minimize tray distortion caused by clip forces.

DESCRIPTION OF THE PRIOR ART

[0003] Small components such as semiconductors are often stored or shipped in molded plastic trays such as tray 10 shown in Fig. 1. With the components (not shown) in pockets 12, a cover such as cover 14 is placed over the tray 10 for captivating the components in the pockets 12. It is then often necessary to apply a device to secure the top 14 to the tray 10. For example, Fig. 2 illustrates a two part clip apparatus 16 used to clamp a tray and cover together, or a stack of trays and a cover together. The height of leg 18 is designed to accommodate the height of the stack. Fig. 3 illustrates the use of a two part clip apparatus 20 for securing a cover 22 to a tray 24. Fig. 4 illustrates another type of tray clip 26.

[0004] In order for the stack of trays to be secure, the clip provides a compressive force to the stack. Prior art designs apply force to a central area of the bottom of the stack, which eventually causes permanent warp/distortion of the trays. Prongs such as 28 (Fig. 2) are used at the stack top, with the opposing force in the central area of the bottom of the stack. In Fig. 2, each of the extensions 30 slide under the corresponding mating part and provide an interference, causing the

base 32 to bend in a manner that results in the clip applying a spring force when the clips are installed on a stack.

[0005] Fig. 4 shows another clip apparatus 26 with two leaf springs 34 for application of force to a stack inserted in the clip 26. The designs of Figs. 2-4 apply a leverage to the tray, operating between each of the top prong contact points and the corresponding area of contact on the central area of the bottom of the stack. The leverage applied to the tray by the spring force is proportional to the distances roughly indicated for example by dimensions D_1 and D_2 resulting in application of a bending force to the trays. This force causes damage due to the application of the force in the thin and weak central area. As the trays warp over time, gaps are produced between trays in a stack. In some cases, the components stored in a tray can fall through the gaps, or be pinched in a gap, causing damage to the component. In addition, when a stack of trays is removed from a clip, and a tray is presented to an automated pick and place machine, the warped, distorted tray can cause pick-up errors. The problem of warped trays is augmented in situations when trays are recycled i.e. re-used after having been used in a stack and become warped. For example, if a used warped tray is placed in a stack with a new tray or new cover, significant gaps are possible, causing tray components to fall out.

SUMMARY

[0006] It is an advantage of this invention in that it provides an improved clip for securing a stack of trays that minimizes warp due to tray clip forces.

[0007] It is a further advantage of this invention in that it provides a clip for securing a stack of trays that confines the retaining forces to the tray edges and therefore minimizes leverage to the stack and reduces tray warpage.

[0008] In one embodiment of the present invention, a clip is provided for holding a stack of at least one tray and tray cover. The clip has a channel structure providing a channel, and having first and second restraining segments positioned on opposing sides of the channel. The segments are attached to a channel base. The restraining segments and base restrict lateral and vertical movement of a stack of trays placed in the channel. At least one pressure member is provided that applies a vertically directed pressure component on a perimeter portion of the stack, forcing the stack into contact with an opposing portion of the channel structure. Stack compressive forces applied by the

clip are substantially limited to tray and cover perimeter rail portions. In a particular embodiment, the clip has a channel base with left and right side retaining walls attached for restricting movement of a stack in left and right directions. Left and right side protrusions above the base extend inward towards the center of the channel from the left and right side walls respectively for captivating the stack in an upward direction. The pressure members include resilient protrusions extending upward from the base on input and output ends of the channel that are configured for applying an upward spring force on corresponding bottom edge/perimeter areas of the stack.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Fig. 1 shows a prior art tray and cover;

[00010] Fig. 2 illustrates a prior art two piece clip;

[00011] Fig. 3 illustrates a clip of the type shown in Fig. 2 holding a stack;

[00012] Fig. 4 shows a prior art clip having two centrally located springs for applying stack pressure;

[00013] Fig. 5 is a perspective view of a clip according to the present invention, and a representative tray with cover in a position for installation in the clip;

[00014] Fig. 6 is a bottom perspective view of the clip of Fig. 5 with a stack installed;

[00015] Fig. 7 is a top perspective view of the assembly of Fig. 6;

[00016] Fig. 8 illustrates a tray using springs to apply force to the left and right edge areas;

[00017] Fig. 9 shows an alternate clip design for applying force to right and left tray perimeter areas;

[00018] Fig. 10 shows another alternate clip design using spring protrusions to apply force to left and right side tray perimeter areas, and shows a tray and cover in position for insertion in the clip, and shows retainer protrusions from a tray base for resisting longitudinal stack movement;

[00019] Fig. 11 shows a stack installed in the clip of Fig. 10; and

[00020] Fig. 12 is a cross sectional view from Fig. 11, showing the position of the retainers.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[00021] While the present invention will be described herein with reference to particular embodiments thereof, a latitude of modifications, various changes and substitutions are intended, and it will be appreciated that in some instances some features of the invention will be employed without a corresponding use of other features without departing from the spirit and scope of the invention as described with respect to the preferred embodiments set forth herein.

[00022] Referring now to Fig. 5 of the drawing, a particular embodiment of the present invention is shown in the form of a clip 36 for holding a stack, such as stack 38 including a tray 40 and cover 42. The clip 36 forms a channel structure providing a channel 44. The structure includes a clip base 46, and has first and second retaining segments 48 and 50 that can be of various forms, illustrated in Fig. 5 as vertically oriented walls providing left and right captivation of a stack. The retaining segments and base restrict lateral and vertical movement of a stack of trays placed in the channel. Vertical captivation of a stack in the particular embodiment of Fig. 5 is provided in the upward direction by right side and left side protrusions 52 and 54, positioned above a channel base 46, and inwardly directed towards a central area of the channel 44 from left and right side restraining apparatus 48 and 50 respectively. The protrusions 52 and 54 are positioned above the base 46 so as to lie above the right and left side edges/rails 56 and 58 of a stack 38 positioned in the channel 44 of the clip 36.

[00023] According to the present invention, a pressure member is provided that applies a vertically directed pressure component on a perimeter portion of the stack, forcing the stack into contact with a opposing portion of the channel structure. The pressure member in the particular embodiment of Fig. 5 is shown as first and second resilient members 60 and 62 extending from the base 46 at first and second opposing ends 64 and 66 of the channel 44. The members 60 and 62 as shown are resilient protrusions from the base 46, extending in an upward direction, having contact areas 68 and 70 positioned so as to contact and apply an upward force on perimeter/edge/rail portions 72 and 74 (Fig. 6) of a bottom tray of a stack inserted in the clip 36. The edge/perimeter/rail portions 72 and 74 are the portions as shown surrounding the bottom cavity 75 of the tray 40. Fig. 6 is a bottom view of the clip 36 of Fig. 5 with the stack 38 inserted in the channel 44. Fig. 6 clearly shows the resilient first and second members 60 and 62 deflected by the edge portions 72 and 74 of the tray 40, the members applying a force on the edge portions 72 and 74,

forcing the stack 38 into contact with the protrusions 52 and 54, and thereby captivating the stack in the clip 36.

[00024] Fig. 7 is a top perspective view of the assembly of Fig. 6, showing the protrusions 52 and 54 extending over the edge portions 56 and 58 of the stack 38.

[00025] The above-described embodiment is given by way of example. This embodiment of the present invention substantially restricts the application of force by a clip to perimeter areas near the edges of the trays, applying the force to the side rail portions of 72 and 74. Various alternate embodiments will be apparent to those skilled in the art upon reading the present disclosure, and these alternate embodiments are included in the spirit of the present invention. For example, instead of the single leaf type members 60, 62 as shown in Figs. 5-7, other configurations could be used, including a plurality of members on either or both of the input and/or output of the channel 44. For example, Fig. 8 shows a clip 76 with springs 78 positioned under the protrusions 80 and 82 for applying a spring force substantially at the perimeter side rail areas of a tray according to the spirit of the present invention. A simple elongated spring of various designs could alternatively be used on each side instead of the two springs 78 per side. Fig. 9 shows a further alternate embodiment of a clip 84 wherein resilient members 86 are shown having an integral, molded design similar to the members 60 and 62 of Figs. 5-7, but smaller and placed near the right and left tray edges, instead of making contact under the front and back tray edge areas as in Figs. 5-7. The springs 78 as shown, are positioned/configured for pressuring a stack of trays against the under side of the protrusions 80 and 82. As a alternate embodiment, springs 83 similar to springs 78 can be alternatively positioned and attached to the protrusions 80 and 82 for pressuring perimeter portions of a stack of trays, forcing the stack against the base 85. As a still further embodiment of the present invention, an apparatus is provided in a plurality of parts, wherein each part provides a clamping action on a perimeter portion of a stack. For example, referring again to Fig. 8, if the portion designated by dashed lines 77 were removed, the result would be two parts 79 and 81 which could be used to restrain a stack in a similar way as described above in describing the clip 76.

[00026] A further alternate embodiment 88 of a clip according to the present invention is illustrated in Fig. 10. Pressure members in the form of resilient leaf members 90 and 92 are shown positioned so as to bring leaf surfaces 94 and 96 into contact with edge portions of a tray 98 when inserted into the clip channel 100. The surfaces 94 and 96 are most effectively positioned below the

protrusions 102 and 104. As a further alternate embodiment, the clip 88 can additionally include flexible retainers 106 and 108 that extend upward from clip base 110 for assisting in securing a stack in the clip. Fig. 11 shows a stack 114 including the tray 98 and cover 112 installed in the clip 88.

[00027] Fig. 12 is a cross section A-A from Fig. 11 showing the positions of the retainers 106 and 108 that protrude into the tray bottom cavity 116 to provide added resistances to movement of the stack 114 for retaining the stack 114 in the clip 88. Fig. 12 shows gaps 109 and 111 between the ends of the retainers 106 and 108. The present invention includes any size gap, including no gap i.e. an interference fit that would more strictly prevent tray movement. The function of retainers 106 and 108 can be accomplished with other structures that will be apparent to those skilled in the art upon reading the present disclosure. In addition to other retaining structures built into the clip, a cut-out such as shown by dotted lines 115 in the tray 98 of Fig. 10 can be included, into which the leaf 92 would reside upon insertion of the tray 78 in the clip 88. The tapered edges 117 would allow the tray 98 to be forced out of the clip, while providing sufficient resistance to retain the stack under normal forces of handling and other anticipated forces, etc.

[00028] Although the designs of Figs. 5-7 and 9-12 are described as a single molded piece, the present invention applies also to clips constructed forming a plurality of separate parts. Also, various types of materials can be used to fabricate the clip. For example, the present invention applies to a clip apparatus with pressure members that are separately manufactured parts. The clip body can also be constructed with two or more parts, such as a separate clip for each of two ends of a stack that restrict the forces to tray perimeter/edge areas.

[00029] The preferred embodiments as described above, and variations that will be apparent to those skilled in the art, limit the application of pressure to the trays to the perimeter area. As a further alternative embodiment, pressure can additionally be applied to non-perimeter areas.

[00030] While the present invention has been described herein with reference to particular embodiments thereof, a latitude of modifications, various changes and substitutions are intended in the foregoing disclosure, and it will be appreciated that in some instances some features of the invention will be employed without a corresponding use of other features without departing from the spirit and scope of the invention as set forth in the appended claims.

CLAIMS

1. An apparatus for clamping together in a stack at least one tray adapted to hold a plurality of integrated circuits in pockets disposed therein and a cover, the apparatus comprising:

a base forming a bottom of a channel, the channel allowing for the insertion and removal of the stack;

first and second restraining segments attached to the base that together with the base form a channel structure, wherein the channel structure restricts substantial movement of the stack both transverse to a length of the channel and perpendicular to a plane of the base; and

at least two pressure members attached to the channel structure for providing pressure on a perimeter of the stack to clamp the stack together between each of the pressure members and a portion of the channel structure, thereby preventing movement of the tray independent of the cover and ensuring that the integrated circuits maintain disposed within the pockets of the tray.

2. An apparatus as recited in claim 1 wherein only the at least two pressure members apply pressure to the stack, and include:

a first resilient member extending from the base on one end of the channel; and

a second resilient member extending from the base on a second end of the channel that is opposite the one end of the channel.

3. An apparatus as recited in claim 1 wherein the first and second restraining segments each include:

a wall extending upward from the base, each wall disposed on respective opposing sides of the channel; and

a protrusion attached to the wall above the base and extending inwards towards the channel so as to extend over the perimeter of the stack when the stack is inserted in the channel.

4. An apparatus as recited in claim 3 wherein the portion of the channel structure is the protrusions: and

wherein the at least two pressure members include:

a first resilient member extending from the base on one end of the channel; and

a second resilient member extending from the base on a second end of the channel that is opposite the one end of the channel.

5. An apparatus as recited in claim 3 wherein the portion of the channel structure is the protrusions: and

wherein the two pressure members include:

a first pressure member extending from the base and positioned adjacent the one side of the channel; and

a second pressure member extending from the base and positioned adjacent the opposing side of the channel.

6. An apparatus as recited in claim 3 wherein the portion of the channel structure is the base; and

wherein the two pressure members include:

a first pressure member extending from one of the protrusions and positioned adjacent the one side of the channel; and

a second pressure member extending from the other of the protrusions and positioned adjacent the opposing side of the channel.

7. An apparatus as recited in claim 1 wherein only the at least two pressure members apply pressure to the stack, and include:

a first pressure member extending from one of the base and one of the protrusions and positioned adjacent the one side of the channel; and

a second pressure member extending from one of the base and the other of the protrusions and positioned adjacent the opposing side of the channel.

8. The apparatus according to claim 1 wherein the apparatus is injection molded in one piece using an injection molding material.

9. The apparatus according to claim 8 wherein the at least two pressure members each are disposed in a first plane different than a second plane formed by a surface of the channel structure to which each of the at least two pressure members are attached.

10. An apparatus as recited in claim 9 wherein the first and second restraining segments each include:

a wall extending upward from the base, each wall disposed on respective opposing sides of the channel; and

a protrusion attached to the wall above the base and extending inwards towards the channel so as to extend over the perimeter of the stack when the stack is inserted in the channel.

11. An apparatus as recited in claim 10 wherein the portion of the channel structure is the protrusions: and

wherein the at least two pressure members includes:

a first resilient member extending from the base on one end of the channel; and

a second resilient member extending from the base on a second end of the channel that is opposite the one end of the channel.

12. An apparatus as recited in claim 10 wherein the portion of the channel structure is the protrusions: and

wherein the two pressure members include:

a first pressure member extending from the base and positioned adjacent the one side of the channel; and

a second pressure member extending from the base and positioned adjacent the opposing side of the channel.

13. An apparatus as recited in claim 10 wherein the portion of the channel structure is the base; and

wherein the two pressure members include:

a first pressure member extending from one of the protrusions and positioned adjacent the one side of the channel; and

a second pressure member extending from the other of the protrusions and positioned adjacent the opposing side of the channel.

14. An apparatus as recited in claim 8 wherein only the at least two pressure members apply pressure to the stack,

15. An apparatus as recited in claim 1 wherein only the at least two pressure members apply pressure to the stack.

16. An apparatus for clamping together in a stack at least one tray and a cover, the apparatus comprising:

horizontal restraining means for restraining the stack laterally in one direction;

vertical restraining means for restraining the stack in a vertical direction; and

pressure means for application of a force to urge the stack into contact with a portion of the vertical restraining means, wherein the pressure means is configured for applying the force only to a perimeter of the stack.

17. An apparatus as recited in claim 16 wherein:

the horizontal restraining means includes first and second side walls spaced apart to form a channel; and

the vertical restraining means includes a base and first and second protrusions each extending inwards from the first and second walls.

18. An apparatus as recited in claim 17 wherein the pressure means is attached to the base.

19. An apparatus as recited in claim 18 wherein the pressure means includes a first resilient member disposed at a first end of the channel and a second resilient member disposed at a second end of the channel.

20. An apparatus as recited in claim 18 wherein the pressure means includes a first resilient member disposed on the base opposite the first protrusion and a second resilient member disposed on the base opposite the second protrusion.

21. An apparatus as recited in claim 17 wherein the pressure means is attached to the first and second protrusions.

22. An apparatus as recited in claim 21 wherein the pressure means includes a first resilient member attached to the first protrusion and a second resilient member attached to the second protrusion.

23. A method of holding a plurality of integrated circuits within pockets of a tray, and wherein the tray has a cover disposed thereover so that the tray and the cover form a stack, the method comprising the steps of:

inserting the plurality of integrated circuits within the pockets of the tray;

covering the tray with the cover to form the stack; and

clamping the stack by applying a force only at a perimeter of the stack using a one-piece re-usable assembly, the step of clamping applying the force at opposite ends of the stack to maintain stability of the stack and ensuring that the integrated circuits maintain disposed within the pockets of the tray.

24. An apparatus as recited in claim 1 wherein said pressure is additionally applied to a non-perimeter area.

25. An apparatus as recited in claim 16 wherein a force is additionally applied to a non-perimeter area.

26. A method as recited in claim 23 wherein pressure is additionally applied to a non-perimeter area.