

CUSHION FOR PACKING DISKS SUCH AS SEMICONDUCTOR WAFERS

Field of the Invention.

5 This invention generally relates to packing disks such as semiconductor wafers. More particularly, this invention relates to a cushion device for use in packing disks.

Description of the Related Art

10 Semiconductor wafers typically include an array of integrated circuits on a disc of semiconductor material. The wafers typically are manufactured in one location, packaged and shipped to another location and then arranged in particular devices. The wafers and the circuits on them must be protected during the packaging and shipping stages of a normal production cycle.

15 A variety of packages have been developed for packing and shipping semiconductor wafers. One known type of package receives a stack of wafers between a top and bottom with a plurality of separators and cushions within the container. Another type of container includes a cassette that receives a series of wafers and the cassette is received between a container top and bottom. Known
20 containers include some form of cushion to bias the wafers into a proper position within the cassette. Examples are shown in U.S. Patent Nos. 4,966,284 and 5,228,568. The arrangement in the first of these patents relies upon cantilevered arms that are formed as part of the top of the container. One disadvantage of this arrangement is that molding the container top is complicated by the presence of the
25 cantilevered arms. Another shortcoming of that arrangement is that the cantilevered arms may not provide a reliable and desired level of bias after several uses.

 The separate cushion of the second patent mentioned above has an advantage over the first example because it simplifies the molding process for making the container top. On the other hand, that arrangement still includes cantilevered
30 cushion members that suffer from the same shortcoming as those in the first patent mentioned above.

There is a need for an improved arrangement for packing semiconductor wafers or other sensitive disks in a container that includes a cassette for receiving and supporting the wafers. This invention provides an improved cushion that satisfies that need.

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SUMMARY OF THE INVENTION

An exemplary disclosed embodiment of a device for packing at least one disk includes a base. A plurality of cushion members each have a first end supported by the base and a second end supported by the base. Each cushion member has a plurality of generally linear segments between the first and second ends. Adjacent generally linear segments are transverse to each other. Each cushion member has at least one contacting portion for contacting a disk. The contacting portions are located near at least one vertex between two of the generally linear segments.

15 One example includes contacting portions on first and second cushion members that are aligned with each other for contacting a single disk. The contacting portions are spaced apart such that an angle between respective reference lines from each of the first and second cushion member contacting portions to a point corresponding to a center of a disk if a disk were engaged by the first and second cushion members is in a range from about 65° to about 180°. In a disclosed example, the angle is in a range from about 120° to about 160°. In one example, the angle is about 150°. Spacing the contacting portions in this way facilitates better handling during packing and better stability during shipping, for example.

20 The various features and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the currently preferred embodiments. The drawings that accompany the detailed description can be briefly described as follows.

BRIEF DESCRIPTION OF THE DRAWINGS

30 Figure 1 schematically illustrates a container designed according to one embodiment of this invention.

Figure 2 shows an elevational view of an example cushion.

Figure 3 is a cross-sectional illustration taken along the lines 3-3 in Figure 2.
Figure 4 is an elevational view of another example cushion.
Figure 5 is a cross-sectional illustration taken along the lines 5-5 in Figure 4.
Figure 6 shows selected features of one example container portion.
5 Figure 7 schematically illustrates a feature of an example embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An example container 20 is schematically shown in an assembled condition in Figure 1. The container 20 is configured to safely package a plurality of wafers or
10 disks 22. The container 20 includes a first portion 24 and a second portion 26, which are secured together by a locking arrangement at 28. In one example, the locking arrangement 28 includes hooks on one of the first or second portions 24 or 26 and an opening on the other such that the hooks are partially received in the opening to secure the portions together.

15 In the illustrated example, the first portion 24 receives a cassette 30. The wafers are received into the cassette 30 in a known manner. The cassette 30 is configured to support the wafers 22 in a manner that keeps them spaced from each other and in a generally stable position within the container 20.

Part of the wafer outer surfaces engage grooves on the cassette 30 and
20 another part of the outer surfaces engage a cushion 40. In the illustrated example, the cushion 40 is snap fit into a secured position relative to the second portion 26. The cushion 40 biases the wafers 22 into a stable position within the cassette 30 and keeps the wafers 22 from shifting about within the container 20 during shipping and handling.

25 The example cushion 40 shown in Figures 2 and 3 includes a base that is at least partially received within the second portion 26 of the container 20. The base 42 in this example includes a first support portion 44 along one lateral edge and a second support portion 46 along a second, opposite lateral edge. Additional support portions 48 and 50 are near a center of the base 42. The illustrated example includes
30 an open space 52 between the support portions 48 and 50.

The example base 42 also has cross bars 54 and 56 that are generally perpendicular to the support portions 44-50. The cross bars 54 and 56 and the

support portions 44-50 are rigid and the base 42 is self-supporting in one example. The base 42 is adapted to be snap fit into the second portion 26 of the container 20 so that cushion members 60 extend toward the wafers in the cassette 30.

The example cushion 40 includes a plurality of cushion members 60 that have a generally stepped configuration when viewed from the perspective of Figure 3. In this example, a plurality of generally linear portions 62, 64, 66, and 68 are transversely oriented relative to an adjacent one of the generally linear portions. In this example, the generally linear portions are generally perpendicular relative to an adjacent linear portion.

One end 70 of each cushion member is supported by one of the lateral support portions 44 or 46. In the illustrated example, the end 70 is supported near an end of an arm 72 that extends from the corresponding support portion 44, 46 such that the end 70 of the cushion members is spaced a selected distance from the base 42. In this example, each arm 72 is rigid in a longitudinal direction of the arm (i.e., in a direction extending between the end 70 of the cushion member and the corresponding support portion 44, 46). In one example, the arms 72 comprise continuous sides of the cushion that are not separated at the position of each cushion member 60. In another example, each cushion member 60 has a dedicated arm 72 that is separate from the other arms 72. In still another example, the arms 72 are partially integrated and partially separated.

An opposite end 74 of each cushion member 60 is supported by one of the example support portions 48, 50 near a center of the base 42. In this example, the second end 74 is supported immediately adjacent the corresponding support portion 48, 50 without any intervening arm.

Having fixed ends 70 and 74 supported by the base 42 provides a more stable arrangement and a more consistently reliable bias and cushion effect compared to previous designs that rely on cantilevered fingers. The stepped configuration of the cushion members 60 and the material selected to form the cushion 40 provide resiliency between the fixed, supported ends 70 and 74 that allows wafers or disks to be received between the cushion 40 and the cassette 30 without any risk of damage to the wafers or disks under expected handling procedures. One example material is polypropylene.

In the illustrated example, each cushion member 60 has a corresponding cushion member on an opposite side of a center of the cushion 40 such that two cushion members 60 are aligned with each other to engage each wafer received between the cushion 40 and the cassette 30. Each cushion member in one example
5 has a grooved wafer-receiving surface that tends to center a corresponding portion of a wafer edge along the cushion member.

The illustration of Figure 3 shows the cushion members 60 in a first configuration where the stepped configuration has a first angle between adjacent ones of the generally linear portions 62-68. When the cushion 40 engages at least
10 one wafer within the container 20, at least some of the linear portions 62-68 move responsive to contact with the wafer such that the relative angle between them changes. In one example, at least the centrally located linear portions move as the cushion member 60 flexes and the angle between the adjacent moving pieces becomes larger.

15 Figures 4 and 5 show another example cushion 40', which may be useful for packaging wafers of a different size or different type than wafers for which the example cushion 40 of Figures 2 and 3 is suitable. In this example, each cushion member 60' has fewer linear portions 80, 82, 84 and 86 compared to the example of Figures 2 and 3. In this example the second ends 74' of the cushion members 60'
20 are secured to a single support portion 48 near a center of the base 42. Otherwise the cushion 60' performs like the cushion 60 of the previously described example.

Referring to Figure 7, a feature of a disclosed example is schematically illustrated, which provides better interaction between the cushion members 60 and the disk 62 especially during assembly of the container 20. Conventional wisdom
25 has been to arrange a cushion member near a top of a container such that the cushion member contacts a disk near a top edge of the disk within the container. Considering the positions on the face of an analog clock, most cushion designs make contact with the disk between 11 o'clock and 1 o'clock. One example embodiment of this invention includes spacing apart contact locations between the cushion
30 members and a disk to provide a more stable arrangement.

Referring to Figures 1 and 5, each cushion member 60 includes at least one contacting portion 90 near a vertex 92 between two adjacent generally linear

segments of the cushion member. The example in Figure 1 has two contacting portions 90 for each cushion member 60. The example of Figure 5 has one contacting portion 90 for each cushion member 60'. The contacting portions 90 in the illustrated examples are located near a vertex 92 between generally
5 perpendicularly aligned, adjacent linear portions of the cushion member.

As can be appreciated from Figure 7, one example includes positioning the contacting portions 90 such that they are spaced apart so that when they contact a disk 22, an angle between respective reference lines 94 and 96 is within a selected range that is greater than the conventional spacing. In Figure 7, the example disk 22
10 has a center point 98. The reference lines 94 and 96 are taken between the contacting portions 90 and the center point 98. An angle α between the reference lines 94 and 96 in one example is within the illustrated range shown at 99 (e.g., the shaded region in the illustration). In one example, the range extends from about 65° to about 180°. One example includes positioning the contacting portions to be
15 within a range from about 90° to about 170°. A more particular example includes a range for the angle α between about 120° and about 160°. In one particular example, the angle α is set to about 150°. Using the face of a clock for discussion purposes, one example includes positioning the contacting portions 90 so that they make contact with an edge of a corresponding disk 22 between about 9 o'clock and about
20 10:30 on one side and between about 1:30 and 3 o'clock on the other side.

Keeping the angle α greater than 65° and less than 180° provides better handling procedures. During assembly of a container 20, as the top portion 26 is placed in position on the bottom 24, with conventional arrangements, there is a tendency for more than one disk to be engaged by a set of corresponding
25 cantilevered fingers, for example. This is due, in part, because of the close proximity of the positions where such fingers contact the disks (i.e., within a range less than 60° apart). By spacing apart the contacting portions 90 a greater distance, the illustrated example reduces a tendency for more than one disk to be engaged by a corresponding set of cushion members 60 as the container is assembled into a closed
30 condition.

Keeping the contacting portions 90 further down the sides of a disk within the range illustrated at 99 in Figure 7 also provides enhanced stability for keeping

the disks in a more fixed position within a container 20 during shipping and handling, for example. The wider spring cooperates with other features of the container assembly to limit lateral movement of the disks 22.

5 The second portion 26 of the container 20 in the example of Figure 6 includes a locking feature 100 on an inside surface 102 for securing a selected cushion 40 in place within the container 20. In one example the locking feature comprises a plurality of tabs that are arranged to allow the base 42 to snap into place on the second portion 26. The same locking feature allows the cushion 40 to be selectively removed from the rest of the container. One advantage to this example
10 arrangement is that it allows the cushion 40 to be replaced or recycled without requiring the entire container 20 to be replaced or recycled. If one portion of the container 40 becomes damaged, for example, that portion can be replaced without the material costs of replacing the entire container or more than one portion of the container.

15 The preceding description is exemplary rather than limiting in nature. Variations and modifications to the disclosed examples may become apparent to those skilled in the art that do not necessarily depart from the essence of this invention. The scope of legal protection given to this invention can only be determined by studying the following claims.

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CLAIMS

We claim:

1. A device for packing at least one disk, comprising;
5 a base; and
a plurality of cushion members having
a first end supported by the base and
a second end supported by the base,
each cushion member having a plurality of generally linear segments
10 between the first and second ends, adjacent ones of the generally linear segments are
transverse to each other, each cushion member having at least one contacting portion
for contacting a disk near at least one vertex between two of the generally linear
segments.
- 15 2. The device of claim 1, comprising a first plurality of the cushion members
having first ends supported near one lateral edge of the base and second ends
supported near a central portion of the base and a second plurality of the cushion
members having first ends supported near an opposite lateral edge of the base and
second ends supported near the central portion of the base.
- 20 3. The device of claim 2, wherein the second ends of the first plurality of
cushion members is spaced from the first ends of the second plurality of cushion
members.
- 25 4. The device of claim 2, wherein the base includes openings between the first
and second ends of each of the plurality of cushion members.
5. The device of claim 4, wherein the base includes spaced apart support
portions near the central portion of the base, each of the spaced apart support
30 portions supporting the second ends of a corresponding one of the plurality of
cushion members.

6. The device of claim 1, wherein each cushion member has a plurality of the contacting portions.
7. The device of claim 1, wherein a first of the cushion members and a second of the cushion members aligned with and parallel to the first cushion member are positioned so that the contacting portions of the first and second cushion members are spaced apart such that an angle between respective reference lines from each of the first and second cushion member contacting portions to a point corresponding to a center of a disk if the disk were engaged by the first and second cushion members is in a range from about 65° to about 180°.
8. The device of claim 7, wherein the angle is in range from about 100° to about 170°.
9. The device of claim 7, wherein the angle is in a range from about 120° to about 160°.
10. The device of claim 7, wherein the angle is about 150°.
11. The device of claim 1, wherein each generally linear segment of each cushion member is generally perpendicular to an adjacent linear segment of the corresponding cushion member.
12. The device of claim 11, wherein at least the linear segments on each side of the vertex near the contacting portion of each cushion member move relative to each other responsive to engagement between the contacting portion and a disk.
13. The device of claim 1, comprising a container top and a container bottom adapted to contain at least one disk and wherein the base is received at least partially against a portion of the top.

14. The device of claim 13, wherein the top includes a plurality of locking members that secure the base in a desired position relative to the top.
15. A device for packing at least one disk, comprising:
5 a base; and
a plurality of cushion members depending from the base,
each cushion member having at least one contacting portion for contacting a surface on a disk, the contacting portion on a first cushion member and the contacting portion on a second cushion member aligned with and parallel to the first
10 cushion member are spaced apart such that an angle between respective reference lines from each of the first and second cushion member contacting portions to a point corresponding to a center of a disk if the disk were engaged by the first and second cushion members is in a range from about 65° to about 180°.
- 15 16. The device of claim 15, wherein the angle is in range from about 100° to about 170°.
17. The device of claim 15, wherein the angle is in a range from about 120° to about 160°.
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18. The device of claim 15, wherein the angle is about 150°.
19. The device of claim 15, wherein each cushion member includes
a first end supported by the base and
25 a second end supported by the base,
each cushion member having a plurality of generally linear segments between the first and second ends with the at least one contacting portion for contacting a disk near at least one vertex between two of the generally linear segments.
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20. The device of claim 19, wherein each generally linear segment of each cushion member is generally perpendicular to an adjacent linear segment of the corresponding cushion member.