

TITLE OF THE INVENTION

A METHOD OF INSPECTION OF COVER TAPE IN SEALING POSITION ON A CARRIER TAPE

BACKGROUND OF THE INVENTION

- 5 The present invention is related in general to the field of semiconductor devices and a method for inspection of cover tape for high density storage and transport of semiconductor devices.

DESCRIPTION OF THE RELATED ART

10 In general, semiconductor devices are packed by the manufacturer, and then transported to customers, in carrier tapes wound onto a reel. Cavities are embossed into the tape to form pockets designed according to industry standards; in each pocket is commonly accommodated one semiconductor device of given size and configuration.

A layer of transparent cover tape is used to seal the white paper carrier tape such that the semiconductor device is positioned within a tape pocket.

15 In visual inspection of proper sealing of the transparent cover tape sealed on white paper carrier tape, it is assumed that all are in line and proper as it is difficult to see the alignment in right position. The checking of the alignment in the right position has to be check one by one and therefore the checking of the sealing properly is high labour intensive, costly and difficult to check visually. A detailed 100% inspection on in person visual inspection is often time-consuming and requires skilled operators in carrying out visual inspection. The existing
20 method is high probability of human error.

The excessively high or low adhesion strength or uneven adhesion strength of transparent cover tape may cause certain problems such as the device will fly out or during next process SMT, the tape may not be able to be peeled off easily. There is a risk of chip components missing or dropping or stolen or replace by others. The chip components are in general, very
25 tiny and light, and can become unprotected and easier to be stuck on the cover tape if the sealing marks are not sealed in the right position.

When the adhesion strength is excessively low, the sealed cover tape may be separated from the carrier tape due to the unexpected minor bumping, and the components drop off from the carrier tape.

In U.S. Pat. No. 5,648,136, issued on Jul. 15, 1997 (Bird, "Component Carrier Tape"), the design of a flexible carrier tape for storage and delivery of components, and the advancement mechanism of the tape system are described. Aligned pockets in the tape have an adhesive thermoplastic elastomer on the bottom wall in order to retain the components in the pockets.

- 5 It is difficult for the proposed system to meet the stringent storage and delivery reliability requirements of advanced semiconductor devices, and to allow easy component removal by the customer for rapid component assembly.

U.S. Pat. No. 5,729,963, issued on Mar. 24, 1998 (Bird, "Component Carrier Tape"), and U.S. Pat. No. 5,846,621, issued on Dec. 8, 1998 (Nagamatsu, "Component Carrier Tape Having
10 Static Dissipative Properties"). In the latter patent, a layer of static dissipative acrylic polymer is added to the strip portion of the carrier system. The cover is releasably, adhesively bonded to the strip portion, covering a plurality of pockets. The acrylic polymer is also used to reduce the temperature at which the cover is bonded to the strip portion.

U.S. Pat. Nos 5,234,104, issued on Aug. 10, 1993 (Schulte et al., "Carrier Tape System"),
15 describes a cover strip having a top surface and opposed side walls extending downwardly from the top surface. The opposed sidewalls are spaced apart from each other a distance substantially equal to the width of the base strip. The cover strip further includes retaining means formed integrally therewith for mechanically engaging and holding down thin component parts seated in cavities formed in the base strip. The retaining means is comprised
20 of a pair of spaced apart rail members which are formed coextensive with the cover strip extending longitudinally to the sidewalls and projecting downwardly and outwardly from the top surface thereof. The rail members are flared outwardly at a slight angle toward the respective opposed sidewalls. The proposed solution is expensive, impractical to assemble by the manufacturer and impractical to unload by the customer.

25 U.S. Pat. No. 5,931,337, issued on Aug. 3, 1999 (Ando et al., "Semiconductor Accommodating Devices and Method for Inserting and Taking Out Semiconductor Devices"), describes an embossed tape, wound on a reel, without using the customary top cover tape. The embossed tape has a bottom wall for placing a semiconductor device thereon, two sidewalls upwardly extending from both side edges of the bottom wall, and top walls having an opening. The
30 sidewalls are formed such that the semiconductor device inserted through the opening is held by the sidewalls with the semiconductor device placed on the bottom wall. The arrangement is inflexible for geometrical changes of the device outlines, and the reliability of transportation is questionable.

An urgent need has arisen to provide a method of inspection of cover tape top sealing in position on a carrier. The method allows to check the transparent cover tape is sealed properly and confirmed no tampering being made, which ensure that the component within the tape pocket is a genuine part.

5 SUMMARY OF THE INVENTION

According to the present invention, there is provided a method of inspection of cover tape top sealing in position on a carrier tape having a plurality of pitch holes. A layer of transparent over tape sealed on a white paper carrier tape will have a sealed mark on a right position on the carrier tape. There are two situations needed to be observed, the top sealing mark has to
10 be in a right position, and there is no top sealing shift of the mark.

A main object of the present invention is to provide a method of inspection of cover tape top sealing in position on a carrier tape having a plurality of pitch holes, the method comprising:

installing a software system which is able to distinguish a sealing mark and defects formed on the carrier tape;

15 capturing an image of the cover tape, wherein the cover tape appears to be black, and the sealing mark formed on the carrier tape as white and in a straight continuation line having an edge exactly touching the pitch hole at one point, indicating that the cover tape is normal and the sealing is without defect; and wherein the sealing mark formed on the carrier tape as white and in a straight continuation line having an edge touching the pitch hole more than one point
20 or cover the pitch hole, indicating that the cover tape and the sealing is improper.

Yet another main object of the present invention is to provide a method of inspection of cover tape top sealing in position on a carrier tape having a plurality of pitch holes, the method comprising:

installing a software system which is able to distinguish a sealing mark and defects formed on
25 the carrier tape;

capturing an image of the cover tape, wherein the cover tape appears to be black, and the sealing mark formed on the carrier tape as white and in a straight continuation line, indicating that the cover tape is normal and the sealing is without defect; and wherein a discontinuation line or a non-straight continuation line indicates that the sealing of the cover tape is improper.

Still a further object of the present invention to provide a method of inspection of cover tape top sealing in position on a carrier tape, wherein the plurality of pitch holes are arranged in alignment along one edge of the carrier tape.

5 Still a further object of the present invention is to provide a method of inspection of cover tape top sealing, wherein a shift over of the sealing mark indicates that the sealing of the cover tape is a fail unit.

Yet a further object of the present invention is to provide a method of inspection of cover tape top sealing, wherein a shift over of the cover tape indicates the sealing is a defected sealing.

10 Yet still a further object of the present invention is to provide a method of inspection of cover tape top sealing, wherein the cover tape is a transparent tape.

Still yet another object of the present invention is to provide a method of inspection of cover tape top sealing in position, wherein a plurality of tape pockets are provided on the carrier tape for holding passive components, and the cover tape covers the tape pockets containing a passive component in each of the tape pocket.

15 A further object of the present invention is to provide a method of inspection of cover tape top sealing in position, wherein the tape pockets are arranged in linear on the carrier tape.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view showing a carrier structure with a transparent cover to cover the semiconductor device within the tape pocket in accordance with the present invention.

20 FIG. 2 schematically shows that the transparent cover tape as black and the sealing mark as white and the white carrier reel as white in accordance with the present invention.

FIG. 3A schematically shows the white sealing mark being seen very clear sealed, which indicates a pass unit of properly sealed semiconductor device.

25 FIG. 3B schematically shows the while sealing mark being sealed improperly, which indicates a fail unit of not properly sealed semiconductor device.

FIG. 4 schematically shows sealing mark measurement in accordance with the present invention.

FIG. 5A illustrates top sealing sealed in a right position in accordance with the present invention, wherein this is a pass unit.

FIG. 5B illustrates top sealing sealed shifted, and covered the pitch holes in accordance with the present invention, wherein this is a fail unit.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

FIG. 1 is a schematic view showing a carrier structure (100) with a transparent cover to cover the semiconductor device within the tape pocket in accordance with the present invention.

As shown in the figure, the carrier (10) is an elongated thin stripe (10) being made from paper or embossed tape or the like material and is provided with a first edge (21) and a second edge (22). According to the present invention, the carrier (10) is provided with a plurality of pitch holes (16) along one edge of the carrier (10), and on the other side of the carrier (10), there are a plurality of tape pockets (14) for the containing of chip component (18) in each of the tape pocket (14). The pitch holes (16) are arranged in a row and each of the pitch holes (16) are equally spaced apart. Similarly, the tape pockets (14) are spaced apart equally. The chip component (18) is kept within the tape pocket (14). A transparent cover tape (12) is being used to cover the tape pocket (14) so as to seal the chip component (18) within the individual tape pocket (14). When the cover tape (12) seals the tape pocket (14) one edge of the cover tape (12) touches the pitch holes (16) at one point tangential to the pitch holes (16). The other edge of the cover tape (12) is in parallel to the second edge (22) of the carrier (10). The transparent cover tape (12) is provided with adhesive at one surface thereof so as to secure the chip component (18) within the tape pocket (14). When the transparent cover tape (12) is securedly applied onto the carrier (10) to cover up the tape pocket (14), and when the system of the present invention will indicate and shows in FIG. 2 that the cover tape (12) is black and the sealing mark (24) of the cover tape (12) on the carrier (10) is white. FIG. 2 schematically shows that the transparent cover tape (12) as black and the sealing mark (24) as white.

In accordance with the preferred embodiment of the present invention, there is provided a method of inspection of transparent cover tape (12) in sealing onto a tape paper (10) having a plurality of pitch holes (16), the method comprises the steps of :

installing a software system which is able to distinguish a sealing mark (24) and defects formed on the carrier tape (10);

capturing an image of the transparent cover tape (12), wherein the cover tape (12) appears to be black, and the sealing mark (24) formed on the carrier tape (10) as white and in a straight continuation line, indicating that the transparent cover tape (12) is normal and the sealing of the cover tape (12) onto the tape pocket (14) is without defect; and wherein a discontinuation line or a non-straight continuation line indicates that the sealing of the cover tape (12) is

improper. In another preferred embodiment, there is provided a method of inspection of transparent cover tape (12) on a carrier tape (10) having a plurality of pitch holes (16), the method comprises the steps of:

installing a software system which is able to distinguish a sealing mark (24) and defects formed on the carrier tape (10);

capturing an image of the transparent cover tape (12), wherein the transparent cover tape (12) appears to be in black, and the sealing mark (24) formed on the carrier tape (10) as white and in a straight continuation line having an edge exactly touching the pitch hole (16) at one point, indicating that the cover tape (12) is normal and the sealing is without defect; and wherein the sealing mark (24) formed on the carrier tape (10) as white and in a straight continuation line having an edge touching the pitch hole (16) more than one point or cover the pitch hole (16), indicating that the cover tape (12) and the sealing of the tape pocket (14) is improper.

In accordance with the present invention, the plurality of pitch holes (16) are arranged in alignment along one edge of the carrier tape (10), and if there is a shift over of the sealing mark (24), it is an indication that the sealing of the cover tape (12) of the tape pocket (14) is a fail unit.

FIG. 3A schematically shows the white sealing mark (24) being seen very clear sealed, which indicates a pass unit of properly sealed semiconductor device. If the transparent cover tape (12) is sealed onto the carrier (10), the white sealing mark (24) is a straight white line without distortion. In other words, the edge of the white sealing mark (24) is a continuation straight line. As shown in FIG. 3A, this is a pass unit and the white sealing mark (24) can be seen very clearly, meaning the seal of the tape pocket (14) is proper.

FIG. 3B schematically shows the while sealing mark (24) being sealed improperly, which indicates a fail unit of not properly sealed semiconductor device. The white sealing mark (24) is not in a continuation but is distorted. The discontinuation or distorted white marking (24) is an indication that the transparent cover tape (12) has been tampered. The image taken by the system clearly shows that the sealing of the transparent tape (12) onto the tape pocket (14) is improper.

In accordance with the preferred embodiment of the method of inspection of cover tape top sealing, a shift over of the cover tape (12) indicates the sealing is a defected sealing.

FIG. 4 schematically shows sealing mark measurement in accordance with the present invention. The software of the system in accordance with the present invention is able to

measure the width of the white marking (24). The box area is the area to be inspected. If the sealing appears white, the sealing is good. If the white marking contains black color, the sealing is bad.

5 In the present method, a plurality of tape pockets are provided on the carrier tape for holding passive components, and the cover tape (12) covers the tape pockets (14) containing a passive component (18) in each of the tape pocket (14), and the tape pockets (14) are arranged in linear on the carrier tape (10).

10 FIG. 5A illustrates top sealing sealed in a right position in accordance with the present invention, wherein this is a pass unit. As shown in the figure, one edge of the transparent cover tape (12) has a distance away from the tape pocket (14). At this point, the edge of the transparent tape (12) is exactly tangential to the pitch holes (16). This indicates that the top sealing is at the right position on the tape paper (10) and this is a pass unit, meaning there is no tampering of the sealing tape (12).

15 FIG. 5B illustrates top sealing sealed shifted, and covered the pitch holes in accordance with the present invention, wherein this is a fail unit. The distance between the edge of the transparent cover tape (12) to the tape pocket (14) is not the same, therefore it is confirmed that the top sealing cover tape (14) has been shifted, and the edge of the covering tape has touches the pitch holes (16)

20 Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention

CLAIMS

1. A method of inspection of cover tape top sealing in position on a carrier tape having a plurality of pitch holes, the method comprising:

installing a software system which is able to distinguish a sealing mark and defects formed on the carrier tape;

capturing an image of the cover tape, wherein the cover tape appears to be black, and the sealing mark formed on the carrier tape as white and in a straight continuation line, indicating that the cover tape is normal and the sealing is without defect; and wherein a discontinuation line or a non-straight continuation line indicates that the sealing of the cover tape is improper.

2. A method of inspection of cover tape top sealing in position on a carrier tape having a plurality of pitch holes , the method comprising:

installing a software system which is able to distinguish a sealing mark and defects formed on the carrier tape;

capturing an image of the cover tape, wherein the cover tape appears to be black, and the sealing mark formed on the carrier tape as white and in a straight continuation line having an edge exactly touching the pitch hole at one point, indicating that the cover tape is normal and the sealing is without defect; and wherein the sealing mark formed on the carrier tape as white and in a straight continuation line having an edge touching the pitch hole more than one point or cover the pitch hole, indicating that the cover tape and the sealing is improper.

3. The method of inspection of cover tape top sealing in position on a carrier tape as set forth in Claim 2, wherein the plurality of pitch holes are arranged in alignment along one edge of the carrier tape.

4. The method of inspection of cover tape top sealing as set forth in Claim 3, wherein a shift over of the sealing mark indicates that the sealing of the cover tape is a fail unit.

5. The method of inspection of cover tape top sealing as set forth in Claim 1, wherein a shift over of the cover tape indicates the sealing is a defected sealing.

6. The method of inspection of cover tape top sealing as set forth in Claim 1, wherein the cover tape is a transparent tape.

7. The method of inspection of cover tape top sealing in position as set forth in Claim 1,
5 wherein a plurality of tape pockets are provided on the carrier tape for holding passive components, and the cover tape covers the tape pockets containing a passive component in each of the tape pocket.

8. The method of inspection of cover tape top sealing in position as set forth in Claim 7,
10 wherein the tape pockets are arranged in linear on the carrier tape.

9. The method of inspection of cover tape top sealing in position as set forth in Claim 1, wherein the carrier tape is an embossed tape.