

CARRIER TAPE FOR ELECTRONIC COMPONENTS

Related Applications

The present application claims the benefit of U.S. Provisional Application No. 60/377,537 filed May 1, 2002, and herein incorporated by reference in its entirety.

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Field of the Invention

This invention relates to component carrier tape, and more particularly to a component carrier tape having self-aligning pockets.

Background of the Invention

Modern semi-conductors have grown to be extremely complex and are highly susceptible to damage from external influences, such as contaminants, mechanical shock, electrostatic discharges and physical contact. Accordingly, various types of carriers have been developed to protect the delicate semi-conductors as they are transported between the many process steps needed for production. Various types of carriers have been developed for this purpose and are known in the art, including matrix and chip trays designed to carry a batch of components, as well as carrier tapes which are designed to carry the components in a continuous fashion.

Integrated circuit components which must be properly handled and transported include pin grid array (PGA), bare die, bump die, non-radial chip scale packing, ball grid arrays (BGA), and other leadless chip packages. These packages typically have a square or rectangular periphery with a flat upper surface, a flat lower surface, and generally have a relatively thin planar housing. Four side surfaces extend around the rectangular periphery. A lower peripheral corner extends around the periphery at the inner section of the sidewalls and lower surface.

The BGA is currently a popular integrated circuit package. BGA integrated circuits are characterized by the thin planar housing and a plurality of external terminals on the lower surface of the housing. Each external terminal comprises a small solder ball. Like earlier pin grid array integrated circuit packages, the solder ball terminals in a BGA integrated circuit package can be arranged in a two-dimensional array. However, the

terminal density in a BGA integrated circuit package is greater than attainable then with PGA integrated circuit packages.

When transporting BGA integrated circuit packages, it is important that the solder ball terminals of the package be prevented from contacting the surface of the carrier device to prevent damage to the BGA package. Tray type carriers have been developed to meet this need. For example, in U.S. Pat. No. 5,791,486 (Brahmbhatt), owned by the owners of the present invention and which is fully incorporated herein by reference, a tray for integrated circuit components is disclosed having a pocket design wherein the component is supported above the bottom of the pocket by the lower peripheral corner of the component, and wherein no portion of the component terminals are in contact with the surfaces of the tray.

What is still needed in the industry, however, is a carrier tape wherein a component can be supported within a pocket of the carrier tape with limited contact between the carrier tape and the component so that the terminals of the component are not in contact with the tape.

Summary of the Invention

The present invention substantially meets the aforementioned needs of the industry. A carrier tape for storing and transporting integrated circuit components is formed from a strip of material in which pockets are formed for receiving an integrated circuit component. Pockets are generally square or rectangular and have a corner design allowing point support of the component at its lower peripheral corner and without contact of the device terminals with any surface within the pocket or of the tape.

The invention may also include a pocket design for a carrier tape, matrix tray or chip tray in which the pocket corners have self-aligning features as described in U.S. Pat. No. 5,791,486 and in which the corner is provided with a failsafe shelf for supporting a component at its corner if the component becomes misaligned or is upset within the pocket.

The invention thus includes a carrier tape for receiving and seating a plurality of components, each having an upper surface, a lower surface, four corners, and a periphery

with four side surfaces transverse to and intersecting the lower surface at a lower peripheral corner extending around the component. The carrier tape includes a flexible body portion having a top surface. A plurality of pockets is formed in the flexible body portion, the pockets positioned for receiving and confining the component,. Each pocket
5 has an interior, four corners, and four sides, each of the corners having a corner guide including a pair of component contact portions positioned on an incline so that the component contact portions slope toward the interior of the pocket. Each component contact portion includes a guide-in portion, a component seating portion, and a subordinate portion below the seating portion. The incline is continuous through the
10 guide-in portion, the seating portion, and the subordinate portion, whereby when the component is engaged with the seating portion, only the lower peripheral corner of the component is in contact with the body portion.

Brief Description of the Drawings

FIG. 1 is a plan view of an integrated circuit component.

15 FIG. 2 is a side elevational view of the integrated circuit component of FIG.1

FIG. 3 is a perspective view of a single pocket of an embossed carrier tape according to the present invention.

FIG. 3A is an enlarged view of the corner of the pocket depicted in FIG. 3.

20 FIG. 4 is a top plan view of a section of the embossed carrier tape according to the present invention.

FIG. 5 is a longitudinal sectional view at the embodiment shown in FIG. 2.

FIG. 6 is a transverse sectional view of the embodiment shown in FIG. 2.

FIG. 7 is a sectional view of a pocket corner of the embodiment shown in FIG. 4.

25 FIG. 8 is a perspective view of a single pocket of an alternative embodiment of the embossed carrier tape of the present invention.

FIG. 8A is an enlarged view of the corner of the pocket depicted in FIG. 8.

FIG. 9 is a top plane view of the embodiment of FIG. 6.

FIG. 10 is a longitudinal sectional view of the embodiment of FIG. 7.

FIG. 11 is a transverse sectional view of the embodiment of FIG. 7.

FIG. 12 is a sectional view of a pocket corner of the embodiment of FIG. 9.

5 FIG. 13 is a plan view of an embodiment of a carrier tape.

FIG. 14 is a transverse sectional view of the embodiment of FIG. 13.

FIG. 15 is a close-up of the transverse sectional view of FIG. 14.

FIG. 16 is a plan view of an alternative embodiment of a carrier tape.

Detailed Description of the Preferred Embodiment

10 Depicted in FIGS. 1 and 2 is a component 100 in the form of a ball grid array (BGA) integrated circuit 102. Component 100 includes four side surfaces 104, an upper side 106 having an upper planar surface 108, and a bottom side 110 with a bottom planar surface 112. Bottom side 110 may include an array of terminals 114. Component 100 also has corners 116, each of which has a tip 118. A lower peripheral corner 120 is
15 formed by the intersection of side surfaces 104 and bottom planar surface 112. Although component 100 is depicted herein as a BGA device, it will of course be appreciated that component 100 may also be any other similarly configured component such as a pin grade array (PGA), bare die, bump die, non-radial chip scale package, or other leadless chip package.

20 In FIGS. 3-7 is depicted a preferred embodiment of a carrier tape 122 of the present invention. Carrier tape 122 generally includes a flexible body 124 in the form of a long strip of material 126 in which device pockets 128 are arranged seriatim in a longitudinally oriented array. The tape has a top surface 129, and an opposing bottom surface (not depicted). Sprocket holes 130 are arranged along one or both lateral margins 132, 134, of
25 carrier tape 122 to enable the tape to be moved by automated equipment.

Device pockets 128 are defined by a pair of opposing sidewalls 136, a pair of opposing end walls 138 and pocket bottom 140. Pocket corners 142, described further hereinbelow, may be substantially as described as in U.S. Pat. No. 5,791,486 (Brahmbhatt), and provide support for a component 100 disposed in the pocket 128 by
5 contact with the lower peripheral corner 120 of the component. An aperture 144 may be provided in pocket bottom 140 to enable access with automated handling apparatus, or to enable the application of vacuum for holding a component 100 in the pocket 128.

In the embodiment of FIGs. 3-7, each pocket corner 142 includes a corner guide 146, which is V-shaped with two component engagement portions 148, 150, joined at a
10 junction 152. Both the component engagement portions 148, 150, have an inner first face 154 facing the interior 156 of the pocket 128 and a second face 158 generally upright and intersecting the first face 154 at a ridge 160. The ridge 160 constitutes an inclined component contact portion 162 with a guide-in portion 164, a seating portion 166, and a subordinate portion 168 below the seating portion 166. The ridge 160 may be rounded as
15 depicted.

The inner first faces 154 and second faces 158 thus cooperate to form an intersection shaped as a ridge 160 to support the lower peripheral corner 120 of the component 100 and to center the corner 116 between the component engagement portions 148, 150. More specifically, when the component 100 is placed in the pocket 128, the
20 lower peripheral corner 120 will slide downwardly and inwardly along the ridges 160 of the component engagement portions 148, 150, until a point is reached at which further downward and inward motion of the lower peripheral corner 120 is prevented by the ridges 160. Because the inner faces 154, 158, have the same mirror image orientation relative to the pocket bottom 140, the corner 116 will come to rest centered between the
25 component engagement portions 148, 150. Also, with the component at the seating portion 166, the tip 118 of the corner 116 will be separated from the junction 152 so that the component 100 does not touch the junction 152.

The component engagement portions 148, 150, extend or angle toward the adjacent pocket corner 142 as the ridge 160 slopes toward the top surface 129. Although ridge 160
30 is depicted as linear it may also be curved. The orientation of ridge 160 provides improved component seating beyond that of a ridge orientation directly perpendicular to the edge of

the component. The ridges 160 angling toward the pocket corner 142 urge the component corner downward and into the corner 142 for proper seating.

Carrier tape 122 may be formed from any suitable polymer material. Currently it is most preferred that polystyrene material be used, and it is also currently most preferred that the material be carbon loaded to provide electrical conductivity and corresponding static electricity dissipation capability. Pockets 128 may be formed in carrier tape 122 by any suitable method. Currently it is most preferred that pockets 128 be embossed.

In operation, a component 100 may be disposed in each pocket 128 of carrier tape 122. When the component is disposed in the pocket 128 at the seating portion 166, the bottom planar surface 112 of the component 100 will be co-planar with a substrate plane 168 and any terminals 114 of the component 100 will be held spaced apart from pocket bottom 140. The component 100 contacts carrier tape 122 only at lower peripheral corner 120.

FIGs. 8-12 depict a currently most preferred embodiment of the carrier tape 122 according to the present invention. In this embodiment, pocket corners 142 are as described above with the addition of shelf 170. Shelf 170 serves as a failsafe support should a component 100 become misaligned or be upset while disposed in pocket 128.

In normal operation, the bottom surface of a component disposed in pocket 128 is co-planar with substrate plane 168 as previously described and as depicted in FIGs. 10-12. In this position, the bottom planar surface 112 of component 100 is not in contact with shelf 170. If component 100 should become slightly misaligned in pocket 128, however, one or more corners 116 of component 100 will contact shelf 170 preventing further downward movement of the integrated circuit component 100 while still holding terminals 114 away from contact with pocket bottom 140.

Shelf 170 may be used with any of the carrier tape pocket embodiments described herein. In addition, it will be readily appreciated that shelf 170 may be incorporated in any of the pocket corner arrangements of U.S. Pat. No. 5,791,486, previously incorporated by reference herein. Thus, the failsafe feature provided by shelf 170 described above may be provided in other types of carriers, such as matrix trays and chip trays.

Alternative embodiments of carrier tape 122 are depicted in FIGS. 13-16. In one embodiment shown in FIG. 13-15, carrier tape 122 includes pocket corners 172. On both sides of pocket corner 172 is a component engagement member 174. Typically, component engagement member 174 comprises an angled component contact surface 176
5 angled toward pocket bottom 140. When component 100 is properly seated within pocket 128, side surface 104 is generally parallel to a projecting engagement member surface 178 while bottom planar surface 112 is generally parallel to pocket bottom 140.

An embodiment of carrier tape 122 including alternative component engagement members 180 is depicted in Fig. 16. Component engagement members 180 include an
10 angled component contact surface 182 angled toward pocket bottom 140. Component engagement members 180 extend along a substantial portion of opposing sidewalls 184 and opposing end walls 186. When integrated circuit component 100 is properly positioned within pocket 128, lower peripheral corner 120 rests on rests evenly on angled component contact surface 182 such that bottom planar surface 112 is generally parallel to
15 pocket bottom 140.

The present invention may be embodied in other specific forms without departing from the spirit of the essential attributes thereof; therefore, the illustrated embodiments should be considered in all respects as illustrative and not restrictive.

CLAIMS:

1. In combination, a component and carrier tape for receiving and seating the component, the component having an upper surface, a lower surface, four corners, and a periphery with four side surfaces, the four side surfaces transverse to and intersecting the lower surface at a lower peripheral corner extending around said component, the carrier tape comprising:

a flexible body portion having a top surface, and

a plurality of pockets in said flexible body portion, the pockets positioned for receiving and confining said component, each pocket having an interior, four corners, and four sides, each of said corners having a corner guide including a pair of component contact portions positioned on an incline so that the component contact portions slope toward the interior of the pocket, each component contact portion including a guide-in portion, a component seating portion, and a subordinate portion below the seating portion, said incline continuous through the guide-in portion, the seating portion, and the subordinate portion, wherein when the component is received in the pocket and engaged with the seating portion, the lower peripheral corner of the component is in contact with the body portion and all other portions of the component are free from contact with the body portion.

2. A component and carrier tape combination according to claim 1 wherein the pocket further comprises an upright first face and an upright second face intersecting at a ridge, said ridge comprising the component contact portion.

3. A component and carrier tape combination according to claim 2, wherein the first face and the second face are positioned such that each component contact portion is angled toward the closest adjacent corner of the pocket.

4. A component and carrier tape combination according to claim 3, wherein each second face is generally transverse to the pocket side and said first face is intermediate said second face and the closest corner.

5. A component and carrier tape combination according to claim 1, wherein each component contact portion comprises a surface parallel to the closest lower peripheral edge of the component when in the seating position.

6. A component and carrier tape combination according to claim 5 wherein each component contact portion extends substantially the length of said closest lower peripheral edge.

7. A component and carrier tape combination according to claim 5, wherein there are two component contact portions on each side of the component pocket and wherein said two component contact portions are spaced apart.

8. A component and carrier tape combination according to claim 7, wherein each component contact portion is adjacent a corner.

9. A component and carrier tape combination according to claim 1 wherein the component contact portion includes a support shelf, said shelf extending from the incline and sloping toward the interior of the pocket, whereby upon misalignment of the component, one or more corners of the component will contact the shelf so as to prevent further downward movement of the component.

10. A component and a carrier tape for receiving and seating the component, the component having an upper surface, a lower surface, four corners, and a periphery with four side surfaces, the four side surfaces transverse to and intersecting the lower surface at a lower peripheral corner extending around said component, the carrier tape comprising:

a flexible body portion having a top surface with a plurality of pockets defined therein, each pocket including a plurality of component contact portions, each contact portion having at least one component contact surface for engaging the component when the component is positioned in the pocket and properly seated therein, the contact portion surfaces each obliquely positioned with respect to the top surface and disposed so as to engage the lower peripheral corner of the component when the component is properly seated in the pocket, all other portions of the component being free from contact with the body portion.

11. The component and carrier tape of claim 10 wherein at least one of the component contact portions includes a support shelf positioned so as to contact a corner of the component upon misalignment of the component and thereby prevent further downward movement of the component in the pocket.

12. The component and carrier tape of claim 10, wherein the pockets each have an interior, four corners, and four sides, each of the corners having a corner guide including a

pair of component contact portions positioned on an incline so that the component contact portions slope toward the interior of the pocket, each component contact portion including a guide-in portion, a component seating portion, and a subordinate portion below the seating portion, said incline continuous through the guide-in portion, the seating portion, and the subordinate portion, whereby when the component is engaged with the seating portion, only the lower peripheral corner of the component is in contact with the body portion of the tape.

13. The component and carrier tape of claim 12, wherein each component contact portion comprises an upright first face and an upright second face intersecting at a ridge.

14. The component and carrier tape of claim 13, wherein the first face and the second face are positioned such that each component contact portion is angled toward the closest adjacent corner of the pocket.

15. The component and carrier tape of claim 14, wherein each second face is generally transverse to the pocket side and said first face is intermediate said second face and the closest corner.

16. In combination, a component and carrier tape for receiving the component, the component having an upper surface, a lower surface, and a plurality of side surfaces defining a periphery, each side surface intersecting the lower surface at a lower peripheral corner extending around said component, the carrier tape comprising:

a flexible body portion having a top surface with a plurality of pockets formed therein, each pocket having a bottom and including means for engaging the lower peripheral corner of the component so that the component is supported thereon when the component is disposed in the pocket, so that the lower surface of the component is spaced apart from the bottom, and so that all other portions of the component are free from contact with the body portion.

17. A carrier tape and component according to claim 16 wherein said means includes a plurality of component contact portions, each contact portion having at least one component contact surface for engaging the component when the component is positioned in the pocket and properly seated therein, the contact portion surfaces each obliquely positioned

with respect to the top surface and disposed so as to engage the lower peripheral corner of the component when the component is properly seated in the pocket.

18. The carrier tape and component of claim 17 wherein at least one of the component contact portions includes a support shelf positioned so as to contact a corner of the component upon misalignment of the component and thereby prevent further downward movement of the component in the pocket.

19. The carrier tape and component of claim 17, wherein the pockets each have an interior, four corners, and four sides, each of the corners having a corner guide including a pair of component contact portions positioned on an incline so that the component contact portions slope toward the interior of the pocket, each component contact portion including a guide-in portion, a component seating portion, and a subordinate portion below the seating portion, said incline continuous through the guide-in portion, the seating portion, and the subordinate portion, whereby when the component is engaged with the seating portion, only the lower peripheral corner of the component is in contact with the body portion of the tape.

20. The carrier tape and component of claim 19, wherein each component contact portion comprises an upright first face and an upright second face intersecting at a ridge.

21. The carrier tape and component of claim 20, wherein the first face and the second face are positioned such that each component contact portion is angled toward the closest adjacent corner of the pocket.

22. The carrier tape and component of claim 21, wherein each second face is generally transverse to the pocket side and said first face is intermediate said second face and the closest corner.

23. (Cancelled).

24. (Cancelled).

25. (Cancelled).