

CARRIER TAPE AND CARRIER TAPE ASSEMBLY

Technical Field

The disclosure generally relates to carrier tapes, particularly carrier tapes for electronic components, and carrier tape assemblies including a carrier tape and a cover film.

Background

As electronic equipment become miniaturized, it has become desirable to design and manufacture electronic components, such as integrated circuit (IC) chips, to be lighter in weight and smaller in size. Methods for storing and/or transporting such components have evolved over the years. One such method is use of a carrier tape. Carrier tapes are used to store and transport electronic components (such as resistors, capacitors, or integrated circuits) from a component manufacturer to a different manufacturer that assembles the components carried within the carrier tape. These electronic components are mounted onto a printed circuit board (PCB) or other substrate during assembly of electronic equipment, or sub-assemblies that will be used later to build the electronic equipment.

Summary

In some aspects of the disclosure a flexible carrier tape for transporting a plurality of components includes a plurality of spaced apart pockets arranged along a longitudinal direction of the carrier tape and configured to receive the components therein. Each of the pockets includes a pocket opening for receiving the component therethrough and into the pocket, a bottom wall, and one or more sidewalls extending from the pocket opening to the bottom wall. The carrier tape includes a flexible substrate joining the pockets to each other along the longitudinal direction. A substantially continuous heat-activatable adhesive layer conformably covers at least a top surface of the substrate and the bottom and side walls of each of the pockets.

Other aspects of the disclosure relate to a carrier tape assembly including a plurality of alternating pockets and connecting portions arranged along a longitudinal direction of the carrier tape. Each pocket is defined by an interior surface and includes a pocket opening. The connecting portions substantially surround the pocket opening of each of the pockets. A substantially continuous heat-activatable adhesive layer is disposed on the pocket openings side of the carrier tape. The heat-activatable adhesive layer includes a first adhesive portion conformably covering a top surface of the connecting portions at least where the connecting portions substantially surround the pocket openings, and a second adhesive portion conformably covering the interior surface of each of the pockets. A cover film is disposed on the pocket openings side of the carrier tape, such that the first, but not the second, adhesive portions of the heat-activatable adhesive layer are activated and bond the carrier tape to the cover film.

Brief Description of Drawings

The various aspects of the disclosure will be discussed in greater detail with reference to the accompanying figures where,

FIGS. 1 and 2 schematically show a flexible carrier tape having a plurality of spaced apart pockets according to some embodiments of the disclosure;

FIGS. 3 and 4 schematically show the cross sectional views of the flexible carrier tape according some aspects of the disclosure;

FIG. 5 schematically shows the cross sectional view of a carrier tape assembly including a flexible carrier tape and a cover film according to some embodiments of the disclosure;

FIG. 6 schematically shows the interior surfaces of a pocket of the flexible carrier tape according to some embodiments of the disclosure; and

FIGS. 7 and 8 schematically show the top view of the flexible carrier tape according to some embodiments.

The figures are not necessarily to scale. Like numbers used in the figures refer to like components. However, it will be understood that the use of a number to refer to a component in a given figure is not intended to limit the component in another figure labelled with the same number.

Detailed Description of Illustrative embodiments

In the following description, reference is made to the accompanying drawings that form a part hereof and in which various embodiments are shown by way of illustration. It is to be understood that other embodiments are contemplated and may be made without departing from the scope or spirit of the present description. The following detailed description, therefore, is not to be taken in a limiting sense.

Flexible carrier tapes according to the present disclosure are generally used in combination with components, particularly electronic components including memory chips, integrated circuit chips, resistors, connectors, processors and the like. Carrier tapes include a number of pockets formed within the carrier tape at regular intervals. The pockets have a geometry that is compatible with the components to be carried and the components rest within the defined pockets. The pockets of the carrier tape carrying the electronic components generally have an upper opening sealed, for example with a cover film, and the carrier tape is wound around a core or reel for storage or delivery.

Some embodiments of the disclosure relate to a flexible carrier tape having an adhesive layer on the top surface of the carrier tape to bond the carrier tape to the cover film, where the cover film does not have an adhesive layer.

Referring to FIGS. 1-4, a flexible carrier tape (100) configured to store and/or transport a plurality of components (10, 11) may include a flexible substrate (30) having a top surface (31). The flexible substrate (30) may extend substantially along the longitudinal direction (x-axis) of the carrier tape (100). A plurality of spaced apart pockets (20, 21), arranged along the longitudinal direction (x-axis) of the carrier tape (100), may be formed in a row in the flexible substrate (30) and may be configured to

receive the components (10, 11) therein. The flexible substrate (30) may be configured to join the pockets (20, 21) to each other along the longitudinal direction (x-axis).

The flexible carrier tape (100) may have a unitary construction. The flexible carrier tapes according to the present disclosure may have dimensions suitable for use with particular desired electronic components, and the pockets (20, 21) may be spaced apart from each other as suitable for the specific application. Each of the pockets (20, 21) may be configured to receive one of the components (10, 11) therein. For instance, as shown in FIGS. 3 and 4, each of the pockets (20) may include a pocket opening (22) for receiving the components (10,11) therethrough and into the pocket (20). One or more sidewalls (24) of the pocket (20) extend from the pocket opening (22) to a bottom wall (23) of the pocket (20). In some instances, the pockets (20, 21) may have a size of less than 1mm.

Carrier tapes substrates of the present disclosure may be made of any suitable material including, for example, thermoplastic polymeric materials, cardboard, and/or metal foil. In addition, the materials that may be used for the flexible substrate (30) may be dimensionally stable, durable, and readily formable into the desired configuration. Preferably, the material includes one or more of a thermoplastic polymeric material that has a sufficient thickness and flexibility to permit it to be wound about the hub of a storage reel. Suitable thermoplastic polymeric materials include, but are not limited to, polyesters (e.g. polyethylene terephthalate (PET), or polybutylene terephthalate), acrylic, polycarbonate, polypropylene (PP), polystyrene (PS), polyvinyl chloride, acrylonitrile-butadiene-styrene (ABS), amorphous polyethylene terephthalate (APET), polyamide, polyolefins (e.g. polyethylene, polybutene, or polyisobutene), modified poly (phenylene ether), polyurethane, polydimethylsiloxane, acrylonitrile-butadiene-styrene resins, and polyolefin copolymers. In some embodiments, the material may have a melt temperature in the range of about 400°F (204°C) to about 630°F (332°C). The carrier tape may be optically clear, pigmented or modified to be electrically dissipative. In the latter case, the carrier tape may include an electrically conductive material, such as carbon black or vanadium pentoxide, either dispersed within the resin material or coated onto the surface(s) of the formed carrier tape. The electrically conductive material may help dissipate an electric discharge that may occur during removal of the cover film or unwinding of the carrier tape assembly from a storage spool thus helping to prevent damage to the electronic components contained within the pockets of the carrier tape. In addition, dyes, colorants, pigments, UV stabilizers, or other additives may be added to the resin material before forming the carrier tape.

The carrier tape (100) may be used to transport electronic components to be assembled onto a printed circuit board using, say, surface mount technology. For instance, the electronic components (10, 11) are retained within the pockets (20, 21) in the carrier tape (100) and continuous lengths of the carrier tape (100) with electronic components (10, 11) are wound around a carrier reel (not shown) as a supply roll.

A plurality of optional sprocket through holes (80) may be provided in the flexible substrate (30) of the carrier tape (100) to facilitate mechanical handling of the carrier tape. The sprocket through holes

(80) may be spaced apart along the longitudinal direction (x-axis) of the flexible carrier tape (100). In some embodiments, other structures (e.g., notches or printed indicia) may be used in place of, or in addition to, sprocket through holes (80). The sprocket through holes (80) may be disposed, for example, along one or both longitudinal edges of the carrier tape (100). The sprocket through holes (80) can engage
5 with teeth on a sprocketed drive (not shown) as may be present in the drive assemblies of a precision placement equipment used to remove the components (10, 11) from the pockets (20, 21) of the carrier tape (100). The sprocket through holes (80) may be used to advance the carrier tape (100) to a prescribed location such that the component (10, 11) can be placed in or removed from the pocket (20, 21) of the carrier tape (100).

10 In some embodiments, at least the top surface (31) of the substrate (30), the bottom wall (23) and the sidewalls (24) of each of the pockets (20, 21) may be covered with an adhesive layer (40) such that the flexible carrier tape (100) may be configured to bond to a cover film (50) as shown in FIG. 5. The adhesive layer (40), in some embodiments, may be a substantially continuous heat-activatable adhesive layer that conformably covers at least the top surface (31) of the substrate (30), and the bottom (23) and
15 sidewalls (24) of each of the pockets (20, 21).

The heat-activatable adhesive layer (40) according to one or more embodiments may be a polymer including one or more of a polyester, a polyolefin, an ethylene vinyl acetate, an ethylene vinyl chloride, a polyurethane, an acrylic, and a styrene containing polymer, e.g. a styrene-butadiene copolymer or terpolymer. In some embodiments, the heat activatable adhesive layer may be a hot-melt adhesive
20 layer. The hot-melt adhesive may be a polymer, including the polymers indicated here. The hot melt adhesive layer may become tacky at temperatures above its glass transition temperature and/or melt temperature (if it is crystalline/semi-crystalline) allowing good wetting to the substrates to be bonded, e.g., the flexible substrate and cover film. In some embodiments, the heat-activatable adhesive may be dispersed in a solvent or be an emulsion, to facilitate coating the adhesive on, for example, the flexible
25 substrate of the carrier tape. The solvent and the liquid of the emulsion may then be removed via evaporation, providing an adhesive layer on the flexible substrate.

In some aspects, as best shown in FIG. 3 and 5, the flexible carrier tape (100) may be configured to bond to the cover film (50) by selectively heat activating the heat-activatable adhesive layer (40) only in adhesive regions (41) disposed between the pockets (20, 21) such that the heat-activated adhesive
30 regions (41) bond the corresponding regions of the substrate to the cover film (50).

In some aspects, as shown in FIG. 7, each of the heat-activated regions disposed between two adjacent pockets may cover substantially an entire region (32) between the two adjacent pockets. In other aspects, as shown in FIG. 8, each of the heat-activated regions disposed between two adjacent pockets may further substantially surround (33) the pocket opening of each of the two adjacent pockets.

35 In some aspects, the adhesive layer (40) may be disposed in the interior surface of each of the pockets (20, 21). For instance, the bottom wall (23) of each of the pockets (20) includes a major inner surface (25) facing an interior (26) of the pocket (20) and an opposing major outer surface (27) facing

away from the interior (26) of the pocket (20). In some aspects, the adhesive layer (40) may be disposed to conformally cover the major inner surface (25) of the bottom wall (23) of each of the pockets (20). In other instances, the one or more sidewalls (24) of each of the pockets (20) may include a major inner surface (28) facing an interior (26) of the pocket (20) and an opposing major outer surface (29) facing away from the interior (26) of the pocket (20). In some aspects, the adhesive layer (40) may be disposed to conformally cover the major inner surface (28) of the one or more sidewalls (24).

A carrier tape assembly (200) for transporting a plurality of components (10, 11) according to some embodiments is schematically illustrated in FIG. 5. The component (10, 11), in some instances, may have a thickness of about 0.05 mm to about 0.15 mm. In some instances, the plurality of components (10, 11) may be electronic components, including memory chips, integrated circuit chips, resistors, connectors, processors and the like.

The assembly (200) may include the carrier tape (100) according to one or more embodiments of this disclosure. A plurality of alternating pockets (20, 21) and connecting portions (60) may be arranged along a longitudinal direction (x-axis) of the carrier tape (100). As shown in FIG. 6, each pocket (20) may be defined by an interior surface (70) and may include a pocket opening (22). The connecting portions (60) may substantially surround the pocket opening (22) of each of the pockets (20).

The substantially continuous heat-activatable adhesive layer (40) may be disposed on the pocket openings side of the carrier tape (100). The adhesive layer (40) may include a first adhesive portion (41) and a second adhesive portion (42). In some aspects, the first adhesive portion (41) may conformably cover a top surface (61) of the connecting portions (60). For example, the first adhesive (41) may conformably cover the top surface (61) of the connection portions (61) at least where the connecting portions (61) substantially surround (33) the pocket openings as best shown in FIG. 5. The second adhesive portion (42) may conformably cover the interior surface (70) of each of the pockets (20).

The cover film (50) may be disposed on the top surface (31) of the carrier tape (100) to cover the plurality of alternating pockets (20, 21) and the adhesive regions of the heat-activatable adhesive layer (40) disposed on the pocket openings side of the carrier tape (100) may be selectively heat-activated to bond the carrier tape (100) to the cover film (50). For example, the cover film (50) may be disposed on the pocket openings side of the carrier tape (100), such that the first adhesive portions (41), but not the second adhesive portions (42), of the heat-activatable adhesive layer (40) are activated and bond the carrier tape (100) to the cover film (50). In some aspects, the first adhesive portion (41) may substantially cover an entire top surface (32) of the connecting portions (60) disposed between the pocket openings as shown in FIG. 7.

The cover film (50) according to one or more embodiments may be a simplified cover film without an adhesive layer. In some cases, the cover film may include one or more layers of a plastic film such as PET, biaxially oriented polypropylene (BOPP), etc. The bonding between the carrier tape (100) and the cover film (50) may be obtained solely by heat activating selected adhesive regions (41) in the heat-activatable adhesive layer (40) disposed on the top surface of the carrier tape (100) to provide

sufficient bonding force between the carrier tape (100) and the cover film (50). In some embodiments, the cover film (50) may include an adhesive layer, e.g., a second heat-activatable adhesive layer, which facilitates bonding to the heat activatable adhesive layer of the carrier tape.

Various modifications and alterations will be apparent to those skilled in the art and it should be
5 understood that this scope of this disclosure is not limited to the illustrative embodiments set forth herein.

What is claimed:

1. A flexible carrier tape for transporting a plurality of components, the carrier tape comprising:
a plurality of spaced apart pockets arranged along a longitudinal direction of the carrier tape and
5 configured to receive the components therein, each of the pockets comprising a pocket opening for
receiving the component therethrough and into the pocket, a bottom wall, and one or more sidewalls
extending from the pocket opening to the bottom wall;
a flexible substrate joining the pockets to each other along the longitudinal direction; and
a substantially continuous heat-activatable adhesive layer conformably covering at least a top
10 surface of the substrate and the bottom and side walls of each of the pockets.
2. The flexible carrier tape of claim 1, configured to bond to a cover film by selectively heat activating the
heat-activatable adhesive layer only in adhesive regions disposed between the pockets, the heat-activated
adhesive regions bonding the corresponding regions of the substrate to the cover film.
- 15 3. The flexible carrier tape of claim 2, wherein each of the heat-activated regions disposed between two
adjacent pockets covers substantially an entire region between the two adjacent pockets.
4. The flexible carrier tape of claim 2, wherein each of the heat-activated regions disposed between two
20 adjacent pockets further substantially surrounds the pocket opening of each of the two adjacent pockets.
5. The flexible carrier tape of claim 1, wherein the heat-activatable adhesive layer comprises one or more
of a polyester, a polyolefin, an ethylene vinyl acetate, an ethylene vinyl chloride, a polyurethane, an
acrylic, and a styrene.
- 25 6. The flexible carrier tape of claim 1, wherein the substrate comprises one or more of a polyester, a
polycarbonate, an acrylic, a polyurethane, a polyethylene terephthalate (PET), a polypropylene (PP), a
polystyrene(PS), an acrylonitrile butadiene styrene (ABS), and an amorphous polyethylene terephthalate
(APET).
- 30 7. The flexible carrier tape of claim 1, wherein the bottom wall of each of the pockets comprises a major
inner surface facing an interior of the pocket and an opposing major outer surface facing away from the
interior of the pocket, and wherein the adhesive layer conformally covers the major inner surface.
- 35 8. The flexible carrier tape of claim 1, wherein the one or more sidewalls of each of the pockets comprises
a major inner surface facing an interior of the pocket and an opposing major outer surface facing away
from the interior of the pocket, and wherein the adhesive layer conformally covers the major inner surface.

9. A carrier tape assembly, comprising:

a plurality of alternating pockets and connecting portions arranged along a longitudinal direction of the carrier tape, each pocket defined by an interior surface and comprising a pocket opening, the connecting portions substantially surrounding the pocket opening of each of the pockets;

a substantially continuous heat-activatable adhesive layer disposed on the pocket openings side of the carrier tape and comprising a first adhesive portion conformably covering a top surface of the connecting portions at least where the connecting portions substantially surround the pocket openings, and a second adhesive portion conformably covering the interior surface of each of the pockets; and

a cover film disposed on the pocket openings side of the carrier tape, such that the first, but not the second, adhesive portions of the heat-activatable adhesive layer are activated and bond the carrier tape to the cover film.

10. The carrier tape of claim 9, wherein the first adhesive portion substantially covers an entire top surface of the connecting portions disposed between the pocket openings.