SPECIFICATION

MOUNTING METHOD FOR IMAGE SENSOR AND ADHESIVE TAPE USED THEREFOR

BACKGROUND OF THE INVENTION

Field of the Invention

The invention relates to a mounting method for an image sensor using a solid-state image pick-up device.

Description of the Background Art

Currently, in manufacturing process for a solid-state image pick-up device, there have been adopted a method in which a surface protective film having an adhesive layer is adhered to the light receiving section side of the image sensor in order to prevent attachment of dust onto or scratching on a surface of the image sensor in a mounting and manufacturing process.

In the method, a way has been, in more and more cases, employed in a component mounting process in which a terminal section of the image sensor and a mounting board are positioned in place for overlay and in this state put into a solder reflow furnace and thereby connection for the mounting can be achieved at a time, while since in the method, a process in a high temperature region such as soldering is included, a protective film and the adhesive layer thereof requires heat resistance. However, since more of surface protective adhesive tape at present has no heat resistance

enough to endure the process, the surface protective adhesive tape is once peeled off before a mounting process for a component and then, a new surface protective adhesive is again adhered thereon after the mounting process.

There has been another method in which a surface protective adhesive tape made of a highly heat resistant film containing polyimide as a main component is employed, whereas since the polyimide film has a brown hue, visual recognizability is poor and a total light transmittance required for optical inspection after mounting of a component or components is low. Hence, difficulty is encountered upon conducting an optical inspection in a tape adhered state.

There has been still another method in which a film excellent in transparency such as polyethylene terephthalate (hereinafter referred to as "PET") is employed, whereas since an adhesive tape is peeled off due to thermal shrinkage of the film in a high temperature condition as high as 180°C, an adhesive force of the adhesive tape is required to be increased. In this method, however, since an adhesive force increases to a glass surface of the light receiving section of an image sensor, which is an adherent of the adhesive tape cooled after heating, destruction occurs in the adhesive layer of the adhesive tape, leading to an inconvenience that the adhesive layer is partly left behind on the surface of the adherent.

A process using an adhesive tape for use in surface protection is simple and convenient in attachment and peeling-off processes, whereas a charge generated when the adhesive tape is

adhered migrates to thereby charge the adhesive tape and an object to be adhered, while discharge occurs when the tape is peeled off. In company of progress toward down sizing and a higher integration of an electronic device in recent years, phenomena have occurred that a circuit with more of precision is required, discharge resistance of an electron device is lowered and discharge by a tape when being peeled off renders the electron device destroyed.

SUMMARY OF THE INVENTION

Embodiments of the present invention seek to provide a mounting method for an image sensor high in workability, safety and productivity, capable of not only protecting a surface of the image sensor from contamination by foreign substances and scratching in manufacturing process for a solid-state image pick-up device, but also conducting a work without peeling-off of a tape even in a component mounting process under a heating condition such as soldering and in internal inspection process after the component mounting.

Embodiments of the present invention seek to provide a surface protective adhesive film having an effect of preventing generation of static electricity accompanying pealing-off and destruction of a device due to discharge caused by static electricity in a peeling process of the adhesive tape from an image sensor.

Embodiments of the present invention further seek to provide a mounting method for an image sensor in which no exchange of adhesive tapes can be required between before and after a solder reflow

process since the adhesive tape is subjected to a heating process for the solder reflow while an adhesive tape is kept to be adhered to the light receiving section of the image sensor.

Embodiments of the present invention further seek to provide a protective adhesive tape capable of being used in mounting such an image sensor, high in thermal shrinkage, having a proper adhesive force, and having excellent visual recognizability all over the tape.

The inventors have conducted serious studies in order to solve the above problems with the results that it is found that the objects can be achieved by the use of the following mounting method or an adhesive tape shown below, which has led to completion of the invention.

In a first aspect of the invention, there is provided a method for mounting an image sensor, wherein in a mounting process of an image sensor using a solid-state imaging device, with an adhesive tape adhered onto a light-receiving portion of the image sensor, the adhesive tape using polyethylene naphthalate as the base material, having a protrusion for peeling on at least part of the periphery thereof, and having an adhesive layer on at least one surface thereof, which adhesive tape has a side part being in parallel to an edge surface of the image sensor and connecting to the bottom of the protrusion, and a lateral part of the adhesive tape connecting from the edge to the bottom of the protrusion having a shape of any one of an oblique line, a zigzag line, curved line or a combination of these lines, a solder connection reflow of a terminal of the image sensor with a substrate side is performed.

In a second aspect of the invention, there is provided an adhesive tape used for any one of the methods for mounting an image sensor as disclosed above, characterized in that the adhesive tape uses polyethylene napthalate as the base material, has a protrusion for peeling on at least part of the periphery thereof, and has an adhesive layer on at least one surface thereof, and also has a side part being parallel to an edge surface of the image sensor and connecting to the bottom of the protrusion, and a lateral part of the adhesive tape connecting from the edge to the bottom of the protrusion has a shape of any one of an oblique line, a zigzag line, a curved line or a combination of these lines.

In example embodiments, there is provided a method for an image sensor, and in a mounting process for an image sensor using a solid-state image pick-up device, an adhesive tape using a polyethylene naphthalate as a base material and having an adhesive layer on at least one surface thereof is adhered on a light receiving section of the image sensor in mounting process of the image sensor.

According to the methods provided in the example embodiments, not only is a performance protecting a glass surface from contamination by foreign substances and scratching during component transportation, which a conventional function, available, but peeling-off of a tape prior to component mounting, which has been conventionally conducted, can also be unnecessary, because of heat resistance having a polyethylene naphthalate. With a small shrinkage factor of a base material, not only can peeling-off of an adhesive tape due to thermal shrinkage be prevented, but a tape with an adhesive force

lower than that of a conventional tape can also be designed, which increases a working efficiency without leaving an adhesive on a surface of an adherent when the tape is peeled off after component mounting.

Besides, because of high transmittance of the tape, an internal inspection after component mounting can be conducted without peeling off of the tape. Hence, in an inspection process after the component mounting in a solid-state image pick-up device, a hindrance in the inspection process due to reduction in transmittance because of use of the adhesive tape is alleviated, thereby enabling inspection in a state where the tape is kept to be adhered to be realized. As a result, no necessity arises for a process such as re-adhesion of an adhesive tape after the inspection. Since in a process such as transportation after the inspection, as well, shipment can be realized in a state where the adhesive tape is kept to be adhered, securing safety. In addition, a continuous process can be adopted in a state where the adhesive tape is kept to be adhered, thereby enabling improvement on productivity to be realized.

In example embodiments, there is provided a mounting method for an image sensor, and in a mounting process for an image sensor using a solid-state image pick-up device, an adhesive tape using a polyethylene naphthalate as a base material and having an adhesive layer on one surface and an antistatic agent-coated layer on the other surface thereof is adhered on a light receiving section of the image sensor in mounting process of the image sensor.

According to the methods, there is provided a performance

protecting a glass surface from contamination by foreign substances and scratching in transportation of a component or components and not only can peeling-off of a tape prior to component mounting, which has been conventionally adopted, be unnecessary, but peeling-off due to thermal shrinkage of the adhesive tape can also be prevented; therefore, a tape can be designed with an adhesive force lower than that of a conventional tape, increasing a working efficiency without leaving the adhesive on a surface of an adherent in peeling-off of a tape after component mounting. An internal inspection can be conducted without being accompanied with peeling-off of the tape after component mounting, making a process such as re-adhesion of the adhesive tape after the inspection unnecessary. Since, in transportation after the inspection, shipment can be conducted in a state where the adhesive tape is kept to be adhered, safety is secured. Besides, since a continuous process can be conducted in a state where the adhesive tape is kept to be adhered, improvement on productivity can be realized.

By coating an antistatic agent, not only a function to improve productivity is enhanced, but generation of static electricity when an adhesive tape is peeled off can also be suppressed to thereby enable destruction of an electronic device to be prevented. Especially, by coating on the back surface of a base material, attachment and contamination of an antistatic agent to an object to be attached can be alleviated, thereby enabling product yield to be improved.

In example embodiments, there is provided a mounting method for the image sensor

and the method is characterized by that the antistatic agent is a quaternary ammonium salt as a main constituent.

As mentioned above, prevention of generation of static electricity in the mounting process of an image sensor is very important. Especially, an antistatic effect after passage of a high temperature space is required. The inventor has found that an antistatic agent containing a quaternary ammonium salt as a main constituent is an antistatic agent very suitable for the purpose of the invention in consideration of various conditions such as heat resistance and workability and others especially required in the mounting process in addition to a general antistatic effect. With such quaternary ammonium salt adopted, generation of static electricity when a tape is peeled off is suppressed, thereby enabling destruction of an electronic device to be prevented. The term "a quaternary ammonium salt" stated herein is officially synonymous with the term "a quaternary ammonium compound salt", but "a quaternary ammonium salt" is uniformly used in this application.

In example embodiments, there is provided a mounting method for the image sensor and the method is characterized by that the adhesive tape has a projection for peeling-off at at least one part of the outer periphery thereof.

Adhesion and peeling-off of an adhesive tape constitute important steps in mounting an image sensor and it is required not to generate attachment or the like with certainty thereafter. In the invention, a projection for peeling-off is provided at at least one part of the outer periphery which makes it possible to peel off an adhesive tape with much of ease after a manufacturing process

such as inspection is completed or immediate before the use. At this time, an adhesive tape is preferably not to be an obstacle in mounting or soldering of an adjacent part in a mounting state of the image sensor.

In example embodiments, there is provided a mounting method for the image sensor and the mounting method is characterized by that not only the adhesive tape covers the entire light receiving section of the image sensor, but also at least one part of the outer periphery is adhered to the light receiving section so as to have a prescribed distance toward the center side from the edge surface of the image sensor.

While in order to protect an image sensor, an adhesive tape is necessary to have a shape covering the entire light receiving section, if the outer periphery portion of an adhesive tape protrudes from the end surfaces of the image sensor largely outwardly, the adhesive tape becomes an obstacle for mounting or soldering of an adjacent part. That is, it is preferable that the adhesive tape not only is necessary to cover the entire light receiving section, but also should be the smallest possible. Therefore, at least one part, preferably a great part of the outer periphery of the adhesive tape other than the projection, is adhered on the light receiving section so as to have a prescribed distance toward the center side from the end surface of the image sensor.

In example embodiments, there is provided a mounting method for the image sensor and the mounting method is characterized by that the adhesive tape not only has a side portion, parallel to the end surface of the image sensor, and connected to the base of the projection, but also

a side portion extending from the distal end of the projection to the base in the shape of an oblique line, a polygonal line or a curved line, or a combination thereof.

An adhesive tape, as described above, is preferably peeled off with ease after the manufacturing process such as inspection or immediately before the use thereof. Fixing of an adhesive tape requires an adhesive force in a specific value, while if an adhesive force is excessively strong, a part of the adhesive agent may remain when an adhesive tape is peeled off; therefore, the adhesive force is restricted within a specific range. Since, especially, in peeling off the adhesive tape provided with a projection, the projection is pinched and pulled up, in which situation the adhesive tape is easy to be cracked, the invention has found that by having a side portion extending from the distal end of the projection to the base in the shape of an oblique line, a polygonal line or a curved line, or a combination thereof, it is made possible for a tape to be smoothly peeled off from the image sensor.

Since a very small distance is usually allowed between the end surface of an image sensor and the outer periphery of a light receiving section, an adhering position of an adhesive tape is important in mounting the image sensor and even in a case where automatically adhered, it is necessary to confirm an adhering position thereof. Therefore, an adhering position of an adhesive tape can be defined using the tape having a side portion parallel to an end surface of an image sensor and connected to the base of the projection, thereby enabling correct and efficient mounting of an image sensor to be secured.

In example embodiments, there is provided a mounting method for the image sensor and the mounting method is characterized by that the adhesive layer is not provided on a portion of the adhesive tape covering the light receiving section of the image sensor.

In example embodiments of the present invention, a base material and an adhesive layer in connection to a protective adhesive tape for an image sensor are specifically designed so as to ensure a continuous process in a state where the adhesive tape is adhered, and the invention makes it possible that by providing no adhesive layer on a portion thereof covering the light receiving section of the adhesive tape, no adhesive agent remains on a surface of an object to be adhered when the tape is peeled off after part mounting, which increase a working efficiency. In mounting process for an image sensor, a film having at least heat resistance as a base material is used on the light receiving section side of an image sensor, an adhesive tape having no adhesive layer is adhered to the light sensitive section and the image sensor in this state is subjected to a heating process at 170°C or higher, thereby enabling a mounting method for an image sensor high in workability, safety and productivity to be provided.

In example embodiments of the present invention, there is provided a mounting method for the image sensor and the mounting method is characterized by that a thermal shrinkage factor at 150°C of the base material used in the adhesive tape is 1.0 % or less.

That is, since findings have been obtained that as described above, a smaller shrinkage factor of a base material is preferable in order to prevent peeling-off due to thermal shrinkage of an

adhesive tape and it is preferable to set a shrinkage factor of a base material in the above range in mounting an image sensor, a tape can be designed with an adhesive force lower than that of a conventional tape, leading to increase in working efficiency in peeling-off of the tape after the component mounting without leaving the adhesive on a surface of an adherent.

In example embodiments of the present invention, there is provided a mounting method for the image sensor and the mounting method is characterized by that a thermal shrinkage coefficient of the adhesive tape after heating at 180°C for one hour is 1.0% or less.

That is, it is preferably that in mounting of an image sensor, a thermal shrinkage coefficient of the base material is small, and since the process includes especially a step in a high temperature region such as soldering, a finding has been obtained that it is preferable to set a thermal shrinkage coefficient of the base material at a high temperature in the above range and by setting such additional conditions definitely, a working efficiency is further increased.

In example embodiments of the present invention, there is provided a mounting method for the image sensor and the mounting method is characterized by that an adhesive force of the adhesive tape after heating at 180°C for one hour is in the range of from 0.1 to 8.0 N/19 mm width.

That is, in order to prevent peeling-off of an adhesive tape, an adhesive force of a prescribed value or more is necessary, while in order to prevent remains of the adhesive layer after being peeled off from an object to be adhered, an adhesive force of a prescribed value or less is necessary. Especially, in a case where the

manufacturing process includes a mounting process in a high temperature region, a finding has been obtained that it is preferable to set an adhesive force of an adhesive tape under heating condition in the above range, and by setting such additional conditions, a working efficiency is further increased without losing a function of an adhesive tape, without leaving an adhesive agent on a surface of an object to be adhered when the adhesive tape is peeled off after part mounting.

In example embodiments of the present invention, there is provided a mounting method for the image sensor and the mounting method is characterized by that a light transmittance of the adhesive tape is 50% or more.

In mounting of an image sensor, as described above, it is preferable to conduct inspection without being accompanied with peeling-off of an adhesive tape in conducting optical inspection in the interior after the component mounting. In other words, by securing light transmittance of an adhesive tape to be a prescribed value or more, optical inspection can retains such a function. As a result, no necessity arises for a process such as re-adhesion of the adhesive tape after the inspection, and shipment in a state where the adhesive tape is kept to be adhered can be realized in a process such as transportation after the inspection to thereby secure safety. A continuous process can be realized in a state where the adhesive tape is kept to be adhered, thereby enabling improvement on productivity to be achieved.

In example embodiments of the present invention, there is provided an adhesive tape using polyethylene naphthalate as a base material and having an adhesive layer on at least one surface thereof, used in mounting method for any of

image sensors described above.

In the mounting method, a necessity arises for an adhesive tape not only protecting a surface of an image sensor from contamination by foreign substances and scratching, but also capable of conducting a work in a component mounting process under heating condition such as soldering and internal inspection process after component mounting without peeling-off the tape. In the invention, there is provided a surface protective adhesive tape having a base material of polyethylene naphthalate and excellent in thermal shrinkage, adherence and visual recognizability, thereby enabling such requirements to be satisfied. Besides, it is possible to suppress generation of static electricity when the tape is peeled off and to prevent failure in an electronic device.

According to example embodiments of the present invention, as described above, a mounting process or an inspection process of parts or the like of a solid-state image pick-up device makes it possible that a continuous process can be conducted in a state where an adhesive tape is adhered; therefore, a mounting method for an image sensor high in workability and productivity can be provided while a surface of an image sensor is protected. By coating an antistatic agent, productivity is improved, generation of static electricity when the tape is peeled off is suppressed, and thereby destruction of an electronic device can be prevented. In addition, it is possible to provide a protective adhesive tape capable of being used in mounting such an image sensor, high in thermal shrinkage, having a proper adhesive force and excellent in visual recognizability all over the tape.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a descriptive view showing a state where an adhesive tape concerning the invention is adhered to an image sensor;

Figs. 2(A) to 2(D) are descriptive views illustrating shapes of an adhesive tape concerning the invention;

Fig. 3 is a descriptive view showing a basic construction of an adhesive tape having a non-coated portion of an adhesive agent of the invention; and

Fig. 4 is a descriptive view showing another construction of an adhesive tape having a non-coated portion of an adhesive agent of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Description will be given of an embodiment of the invention below.

An adhesive tape of the invention is basically constituted of a tape basic material and an adhesive layer provided on one surface thereof, while a release film may also be adhered to the base material of the adhesive tape. That is, a release film having at least one surface on which a release treatment is applied is adhered onto a base material of an adhesive tape with an adhesive layer interposed therebetween, thereby enabling protection of an adhesive layer and a protection of a surface of an image sensor to be achieved.

With an antistatic agent applied, productivity can be

increased, generation of static electricity when the tape is peeled off is suppressed and destruction of an electronic device can be prevented.

No specific limitation is placed on an antistatic agent used in the invention and any of antistatic agents can be used as far as generation of static electricity is suppressed when the tape is peeled off. For example, methods can be exemplified in which an agent mainly including a quaternary ammonium salt, an inorganic salt, or a metal compound (for example a stannic dioxide or the like) is coated on a base material using a dispersing medium such as water or an arbitrary organic solvent. Especially, an antistatic agent containing a quaternary ammonium salt as a main component is preferably used in the invention because of simplicity and convenience in handling such as solubility in a solvent and a solvent coatability.

In consideration of transfer and contamination of an additive component to a solid-state image pick-up device, which is an object to be adhered, in connection with applications of the invention, it is preferable to treat the back surface side of the base material. In a case where an antistatic agent is provided on a surface of an adhesive layer, the adhesive layer and the antistatic agent unpreferably have a possibility to affect each other.

A projection for peeling off is preferably provided at at least one part of the outer periphery of an adhesive tape. To be concrete, in a state where an adhesive tape 3, as shown in Fig. 1, adhered to the light receiving section 2 of the image sensor 1, a projection 3a at a part of the adhesive tape 3 protrudes from the

end surface 1a of the image sensor 1. In this state, the image sensor 1 is mounted to a substrate, after mounting treatment in which the image sensor 1 passes through solder reflow at a high temperature, workings of the image sensor 1 or function of a mounted substrate are inspected. After the manufacturing process is completed, or immediately before the use, the adhesive tape 3 can be peeled off with very ease automatically or manually.

An adhering position of an adhesive tape 3 is preferably such that part of its outer periphery is between the end face of the image sensor 1 and the light receiving section 2. That is, it is preferable that a width of the adhesive tape 3 is larger than a width of the light receiving section 2 and less than a width of the image sensor 1. As shown in Fig.1, the entire outer periphery of the adhesive tape 3 except for the side 1b of the image sensor 1 covered by the protrusion 3a are preferably located between the end surface of the image sensor 1 and the light receiving section 2. With such a construction adopted, not only is the entire light receiving section 2 covered by the adhesive tape 3, but the adhesive tape can also be prevented from covering peripheral members in mounting the image sensor 1. Note that in a case where there is no other mounting portion with a space where no soldering is necessary in the periphery of the substrate, in a state where the image sensor 1 is mounted on a substrate or the like, a part of the outer periphery portion is sufficiently between the end surface of the image sensor 1 and the light receiving section 2, and the entire periphery is not necessarily required so.

Shapes of the adhesive tapes 3 are illustrated in Figs. 2(A) to

2(D). Illustrated are a case where the projection 3a is provided on one side of an almost square as shown in Fig. 2(A) and a case where an almost rectangle like in Fig. 2(B) or a shape adapted for the image sensor 1.

No specific limitation is placed on a shape of a projection 3a, it is preferable to use a shape that can be pinched by hand or automatically. In addition, a shape that can be easily processed is preferably used. While, for example, squares such as FIG. 2(A) and Fig. 2(B), can be used, the following can also be used: a semicircular shape, a trapezoid as illustrated in Fig. 2(C) and a combination of a square and a trapezoid as illustrated in Fig. 2(D)

It is preferable that in the vicinity of the projection 3a, a side portion 3b connected to the base of the projection 3a is provided so as to be parallel to the end surface 1a of an image sensor 1 as shown in Fig. 1, to be more correct, a side 1b constituting the end surface 1a of the image sensor 1. With such a construction adopted, a definite adhering position can be secured, which makes confirmation of the adhesion easy. In a case where the image sensor 1 is not in the shape of a square as illustrated in Fig. 1 but in the shape of a square with 4 rounded corners and in the shape of an oval or an ellipse, the adhesive tape 3 preferably has a side portion parallel to and in similarity with a side portion of the end surface of the image sensor 1.

In addition, in the projection 3a, a side portion 3c from the distal end 3d connected to the base of the projection is preferably in the shape of an oblique line, a polygonal line or a curved line, or a combination thereof. Since when the adhesive tape 3 is peeled

off, the strongest force acts on the center line of the projection 3a; therefore, in a shape 3e as shown with a broken line of Fig, 2(A), there occurs a possibility of cracking of the adhesive tape 3 or remains of an adhesive agent on the light receiving section 2 caused thereby. Therefore, a shape of the side portion 3C is preferably of capability of dispersing a stress when the adhesive tape is peeled off. No specific limitation is imposed on a concrete shape and any can be adopted as far as a stress can be dispersed. Examples thereof include shapes of side portions 3c as shown in Figs. 2(A) to 2(D). That is, by selecting a shape of a side portion 3c as an oblique line (Fig. 2(C)), a polygonal line (Fig. 2(D)), a curved line (Figs. 2(A) and 2(B)) or a combination thereof (not shown), the side portion 3c can be smoothly peeled off when the adhesive tape 3 is peeled off. Therefore, the whole of the projection 3a can be peeled off with an almost uniform force and the main portion of the adhesive tape covering the light receiving section 2 can be peeled off with an almost uniform force in-plane and in a vertical direction along the peeling off direction X. Note that an inclination angle of an oblique line or a polygonal line and a curvature of a curved line can be arbitrarily set so as to be adapted for a shape of the image sensor 1 and shapes of the whole of the adhesive tape 3 and the projection 3a.

An adhesive tape is preferably not provided with an adhesive layer on a portion covering the light receiving section of an image sensor. Since no adhesive agent remains on a surface of an object to be adhered when the adhesive tape is peeled off after part mounting is completed, working efficiency is increased.

To be concrete, a method for fabricating an adhesive tape can be adopted in which when an adhesive layer 5 is formed as shown in Fig. 3 on a base material 4, the adhesive layers 5 each having a width of b are formed on both ends so as to leave non-coated portion having a width of a in a portion covering a light receiving section of the image sensor in the center of the adhesive tape. No specific limitation is placed on a shape of the adhesive layer 5 as far as a non-coated portion can be basically formed in a portion covering the light receiving section of the image sensor and the various kinds of methods can be adopted as illustrated in Fig. 4, a method in which an arbitrary shape such as (A) a circle or (B) a tetragon is scooped out, and a method in which (C) adhesive layers (5) are formed at 4 corners of a base material 4, and a method in which (D) an inclined non-coated portion with a prescribed width is formed. The oblique lined portions shown in Fig.4 indicate portions on which an adhesive agent is coated.

According to the methods, an adhesive layer 5 is formed on a surface of the image sensor uniformly and so as to secure an adhered area to thereby, to sufficiently secure an adhesive strength to the surface of the image sensor and to at the same time prevent an influence on the light receiving section.

A base material of an adhesive tape is preferably made of polyethylene naphthalate having a heat resistance under a temperature condition of 180°C and visual recognizability in adhesion as a main component in light of a shrinkage factor of the base material and adhesion to an image sensor thereof.

A thickness of an adhesive tape is preferably at least 5 μm or

more in order to prevent fold and tear and besides, more preferably in the range from 10 to 100 μm in consideration of a proper handlability.

No specific limitation is imposed on an adhesive and any adhesive can be used as far as it has heat resistance. To be concrete, there can be exemplified an acrylic adhesive, a silicon adhesive and the like. Since a silicon adhesive is not only excellent in heat resistance, but also easy in adjustment of an adhesive force, the adhesive enables an adhesive tape excellent in handlability to be designed and can be said an especially suitable adhesive material by finally adjusting an adhesive force to any value in peeling-off the tape after completion of mounting.

An acrylic adhesive is, for example, an adhesive made of an acrylic copolymer obtained by copolymerization of a monomer containing at least an alkyl (meth)acrylate. Examples of alkyl(meth)acrylates include: methyl (meth)acrylate; ethyl (meth)acrylate; butyl (meth)acrylate; isoamyl (meth)acrylate; n-hexyl (meth)acrylate; 2-ethylhexyl (meth)acrylate; isooctyl (meth)acrylate; isononyl (meth)acrylate; decyl (meth)acrylate; dodecyl (meth)acrylate; and others. An acrylic adhesive can contain a proper crosslinking agent. Examples of crosslinking agents include: an isocyanate crosslinking agent, an epoxy crosslinkig agent, an aziridine compound, a chelate crosslinking agent and others.

The following other additives can be further added when required: a filler, an aging preventive agent, a pigment, a dye, a silane coupling agent and others. An acrylic adhesive is

comparatively high in heat resistance, which is the most preferable adhesive in the invention.

A thickness of adhesive layer of adhesive tape is in the range of from 1 μm or more and 50 μm or less, preferably in the range of from 3 μm or more and 30 μm or less, and more preferably in the range of from 5 μm or more and 20 μm or less. In order to secure an adhesive layer, it is effective that even small level differences are formed on a surface of a base material and If a thickness is less than 1 μm, there is a possibility that a surface protective tape is deflected to thereby be brought into contact with the light receiving section with a possibility of damage thereto and to at the same time decrease adhesive property. In addition, there arises a possibility to generate pealing-off of an adhesive tape due to thermal shrinkage of the film during heating. If a thickness exceeds 50 μm, there arises a possibility that an adhesive agent covers the light sensitive portion by deformation of an adhesive agent in a slit processing or punching processing of an adhesive tape, or deformation of an adhesive agent due to a pressure when an adhesive tape is adhered, a pressure to an adhesive tape in transportation and heating in mounting. In addition, the adhesive layer of an adhesive tape is preferably a thinner layer in consideration of transmittance.

That is, in order to protect an image sensor, an adhesive tape is required to have a prescribed strength in mounting, it is required to hold an adhering state so as to match an image sensor, and workability is also important. Therefore, an adhesive tape in the invention is found, as results of experimental measurements,

in which the above range of the thickness is the most suitable range. Therefore, by using the adhesive tape with such a thickness of the adhesive layer, it is possible to provide a mounting method for an image sensor high in workability, safety and productivity.

A thermal shrinkage factor of a base material of an adhesive tape in the invention is preferably 1.0% or less and more preferably 0.5% or less in a case where being heated at 150°C for 30 min. This is to prevent peeling-off due to thermal shrinkage. The term, a thermal shrinkage factor, herein is a value measured according to JIS C 2318.

In the invention, a thermal shrinkage coefficient of the adhesive tape after heating at 180°C for one hour is preferably 1.0% or less, more preferably 0.5% or less, further more preferable 0.3% or less. This is because by making an additive condition on a thermal shrinkage coefficient of a base material at a high temperature condition definite, a working efficiency is raised. The "thermal shrinkage coefficient" stated herein is measured when an adhesive tape is left at 180°C for one hour after being adhered to a BA plate. A concrete measuring method for a thermal shrinkage coefficient was conducted in a procedure in which an adhesive tape is cut into pieces in the shape of a square having a side of 20 mm and a sample is adhered to a BA plate, the composite was heated at a temperature of 180°C and a size of the sample before and after heating was measured using a projector (Profile Projector PJ-H3000F, manufactured by MITSUTOYO CORP.) both in MD direction and TD direction. Note that the BA plate is a SUS 304 plate finished to BA No.5 surface according to JIS "BA finish" (No.

BA No.5 finished SUS 304 manufactured by Nippon Kinzoku Co., Ltd.).

In the invention, an adhesive force of an adhesive tape after heating at 180°C for one hour is preferably in the range of 0.1 to 8.0 N/19 mm width, more preferably in the range of from 0.2 N to 5.0 N/19 mm width and more preferably in the range of from 0.3 N to 4.0 N/19 mm width. If an adhesive force exceeds 8.0 N/19 mm, peeling-off of the adhesive tape from an object to be adhered is difficult in peeling off from the object to be adhered in the process with a possibility remaining an adhesive layer on a surface of the object to be adhered, while if an adhesive force less than 0.1N/19 mm, there arises a possibility to generate peeling-off of the adhesive tape due to thermal shrinkage of film during heating. The adhesive force is measured according to JIS Z 0237.

A light transmittance of an adhesive tape in the invention is preferably 50% or more and more preferably 70% or more. This is because in a case where the interior is optically inspected after component mounting as well, the inspection can be conducted without being accompanied by peeling-off of an adhesive tape by securing a light transmittance of the adhesive tape at a prescribed value or more. The term, a light transmittance, herein shows a light transmittance in the visible light region and means a transmittance in the wavelength range of from 400 to 700 nm. In the invention, it is preferable that a transmittance is 50% or more all over the entire wavelength region. If a light transmittance is less than 50%, difficulty is encountered with recognizing results in connection process for a solid-state image pick-up device through

the adhesive tape. A light transmittance herein is measured by means of the following measurement method.

< Measurement Method for Light Transmittance >

(1) Measurement Instrument: A spectrophotometer (MPS-2000, manufactured by Shimadzu Corp.)

(2) Measurement Range: from 400 nm to 700 nm.

(3) Sample Size: A sample is cut off in a proper size adapted to the measurement instrument.

(4) Measurement on an adhesive tape is conducted from the adhesive side. Note that measurement on a base material is conducted from the side on which an adhesive is coated or on which the adhesive is present.

In a case where a release film is used for an adhesive tape, any release film conventionally known may be used. To be concrete, a release film in which a release coat layer, for example a silicone layer, is formed on an adhering surface between an adhesive layer and a base material of a release film may be used. Examples of base materials of release films include paper such as glassine; a resin films such as polyethylene, polypropylene, and polyester.

An adhesive tape of the invention may be cut according to a size in application thereof, for example a solid-state image pick-up device, which is the object. No specific limitation is placed on a working method as far as a uniform shape is held and no remain of adhesive agent is left on a working section and as a working method, punching is preferable in light of productivity.

Examples

Description will be given of the invention using examples showing a construction and an effect thereof in a concrete way. An evaluation method in the examples and others was conducted as follows: It should be understood that the invention is not limited by the examples and the evaluation method concerning the invention.

< Evaluation Method >

Evaluation was conducted on the following items of tapes fabricated under above described conditions.

(1) Shape of Tape after Heating

Samples of the examples and the comparative examples were adhered on glass surfaces and shapes of the tapes after being left at 180°C for one hour were evaluated.

(2) Visual Recognizability in the Case of Assuming Optical Inspection in Interior after Packaging

A box with a height of 5 mm was formed using an acrylic plate and a semiconductor device finished with a connection process was put in the interior thereof. An adhesive tape was adhered onto the surface of the acrylic plate and recognition of the presence or absence of connection to the semiconductor device included inside the acrylic plate was conducted through the tape. Recognition of the effect was conducted by five persons with the naked eye. Criteria of evaluation were the following three levels.

○: The presence or absence of the connection can be clearly recognized.

Δ: The connection can be barely recognized.

×: The connection cannot be recognized.

(3) Discharge Quantity

When an adhering surface of a tape was adhered to a glass surface, left in the state for 30 minutes, and an adhesive tape was peeled off, a discharge quantity was measured. Measurement of a discharge quantity was conducted as followed.

(3-1)

A coaxial cable was connected to the upper portion of a peeled surface at the distal end of a high speed pealing off tester and arranged to move at the same speed as the peeled surface.

(3-2)

The coaxial cable was connected to an oscilloscope to thereby measure a value of electromagnetic wave generated when the tape is peeled off.

(3-3)

Adhesive tapes were cut into pieces each with 20 mm width, a sample was adhered on a glass surface and a test sample was set on the apparatus.

(3-4)

Thereafter, a value of an electromagnetic wave observed when measured at a release angle of 180° and a release speed of 5 mm/min was measured as a discharge value.

(3-5)

The maximum value of an electromagnetic wave peak measured is defined as a discharge value.

(4) Peelability

After each of samples of the examples and comparative

examples described below was adhered onto a glass surface, each sample on the glass surface was left as is at 180°C for 1 hr and thereafter, the sample is evaluated on peelability.

<Example 1>

A solution of an acrylic adhesive was coated on a base material that is made of polyethylene naphthalate with a thickness of 25 μm (a thermal shrinkage factor of the base material was 0.4% at 150°C for 30 min) and the wet coat was dried to prepare an adhesive tape having an adhesive layer with a thickness of 10 μm thereon. The adhesive tape was heated at 180°C for about 1 hr and thereafter, an adhesive force was measured according to JIS Z 0237 to obtain 2.0 N/19mm, a thermal shrinkage factor was 0.15% and a light transmittance was 50% or more (on the average: 88.0%) at a wavelength in the range of from 400 to 700 nm.

<Example 2>

A base material made of polyethylene naphthalate with a thickness of 25 μm was used and a quaternary ammonium salt (NR-121X, manufactured by Colcoat Co., Ltd.) was coated on the back surface side of the base material. Thereafter, a solution of an acrylic adhesive agent was applied on the other surface and the wet coat was dried to form an adhesive layer with a thickness of 10 μm and to thereby fabricate an adhesive tape.

After the adhesive tape was heated at 180°C for about one hour, an adhesive force was measured according to JIS Z 0237 to obtain 2.0 N/19 mm, a thermal shrinkage was 0.15% and a light transmittance of the adhesive tape was 86.0% at 500 nm.

<Example 3>

An adhesive tape was fabricated in a procedure in which coated portions each having a width of 10 mm coated with a solution of an acrylic adhesive agent and non-coated portions each with a width of 10 mm were alternately arranged so as to form a pattern of stripes on a base material made of polyethylene naphthalate with a thickness of 2 μm and the wet coat was dried to thereby form an adhesive layer with a thickness of 5 μm and to obtain an adhesive tape. The adhesive tape was obtained by slitting the adhesive tape with a width of 20 mm so that a non-coated portion is located in the center. The adhesive tape was a = 10 mm and b = 5 mm in Fig. 3.

After the adhesive tape was heated at 180°C for about one hr, an adhesive force was measured according to JIS Z 0237 to obtain 1.0 N/19 mm and a thermal shrinkage was 0.15%.

<Example 4>

An adhesive tape was obtained in a similar way to that in Example 2 with the exception that an adhesive layer with a thickness of 30 μm was fabricated on the adhesive tape.

After the adhesive tape was heated at 180°C for about one hr, an adhesive force was measured according to JIS Z 0237 to obtain 3.0 N/19 mm and a thermal shrinkage was 0.15%.

<Example 5>

An adhesive tape similar to that in Example 1 was fabricated with the exception that the adhesive tape was, as shown in Fig. 2(A) shaped in way such that a projection of a length of 4 mm has side portions each in the shape of an arc with R = 2 (mm) extended from a coverage portion of 11 mm × 12 mm.

<Example 6>

An adhesive tape similar to that in Example 1 was fabricated with the exception that the adhesive tape was, as shown in Fig. 2(C) shaped in way such that a projection of a length of 2.5 mm has trapezoid portion with slops on both side, wherein the top was shorter than the bottom by 1 mm on one side (3b and 3f of Fig. 2(C) was 1 mm each) thereof extended from a coverage portion of 6 mm × 7 mm.

<Comparative Example 1>

An adhesive tape prepared by means of a method similar to Example 1 was obtained with the exception that the base material is a PET film with a thickness of 25 μm (a thermal shrinkage factor of the base material was 1.5% at 150°C for 30 min). The adhesive tape was heated at 180°C for about 1 hr and thereafter, an adhesive force was measured according to JIS Z 0237 to obtain 2.0 N/19mm, a thermal shrinkage factor was 1.3% and a light transmittance was 50% or more (on the average: 91.0%) at a wavelength in the range of from 400 to 700 nm.

<Comparative Example 2>

An adhesive tape prepared by means of a method similar to Example 1 was obtained with the exception that the base material is a polyimide film with a thickness of 25 μm (a thermal shrinkage factor of the base material was 0.2% at 150°C for 30 min). A light transmittance of the adhesive tape was less than 50% at a wavelength in the range of 510 nm or less. The adhesive tape was heated at 180°C for about 1 hr and thereafter, an adhesive force was measured according to JIS Z 0237 to obtain 2.0 N/19mm and a

thermal shrinkage factor was 0.1%.

<Comparative Example 3>

An adhesive tape was obtained in a similar way to Example 2 with the exception that no quaternary ammonium salt was coated on the back surface side of an adhesive layer of the adhesive tape.

After the adhesive tape was heated at 180°C for about one hr, an adhesive force was measured according to JIS Z 0237 to obtain 2.0 N/19 mm, a thermal shrinkage was 0.15% and a light transmittance of the adhesive tape was 88.0% at 500 nm.

<Comparative Example 4>

An adhesive tape was obtained in a similar way to Example 2 with the exception that polyethylene terephthalate (Lumirror S-10#38, manufactured by TORAY INDUSTRIES, INC.) was used as a base material used in an adhesive tape.

After the adhesive tape was heated at 180°C for about one hr, an adhesive force was measured according to JIS Z 0237 to obtain 1.5 N/19 mm, a thermal shrinkage was 1.3% and a light transmittance of the adhesive tape was 90.0% at 500 nm.

<Comparative Example 5>

An adhesive tape was obtained in a similar way to Example 2 with the exception that polyimide (Capton 100H, manufactured by Toray DuPont Co., Ltd.) was used as a base material used in an adhesive tape.

After the adhesive tape was heated at 180°C for about one hr, an adhesive force was measured according to JIS Z 0237 to obtain 2.5 N/19 mm, a thermal shrinkage was 0.1% and a light transmittance of the adhesive tape was 24.5% at 500 nm.

<Comparative Example 6>

An adhesive tape was obtained in a similar way to Example 3 with the exception that no solution of an acrylic adhesive agent was coated in a pattern of stripes.

After the adhesive tape was heated at 180°C for about one hr, an adhesive force was measured according to JIS Z 0237 to obtain 2.0 N/19 mm and a thermal shrinkage was 0.15%.

<Comparative Example 7>

An adhesive tape similar to that of Example 5 was prepared with the exception that a side portion of the projection has a profile of a base with a recessed corner of a right angle (a shape 3e as shown by a broken line of Fig. 2(A)).

<Results>

(1) Shape of Tape after Heating

Neither floating nor peeling-off from a glass surface of a tape was recognized in each of the cases of Examples 1 to 6, and Comparative Examples 3, 6 and 7 using polyethylene naphthalate as a base material, and Comparative Examples 2 and 5 using a polyimide base material, while peeling-off at the end surface of the adhesive tape due to thermal shrinkage was recognized in the case of Comparative Example 1 using PET. In Comparative Example 4, floating at the end surface of the adhesive tape was recognized.

(2) Visual Recognizability

In Table 1, there are shown the results on inspection of visual recognizability in the interior after formation of a package.

[Table 1]

	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6
Tester A	○	○	○	○	○	○
Tester B	○	○	○	○	○	○
Tester C	○	○	○	○	○	○
Tester D	○	○	○	○	○	○
Tester E	○	○	○	○	○	○

	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4	Comparative Example 5	Comparative Example 6	Comparative Example 7
Tester A	○	Δ	○	○	Δ	Δ	○
Tester B	○	Δ	○	○	Δ	Δ	○
Tester C	○	×	○	○	×	×	○
Tester D	○	Δ	○	○	Δ	×	○
Tester E	○	×	○	○	×	×	○

(3) Discharge Quantity

Discharge of 400 mV was recognized in the construction of Comparative Example 3, while the maximum of discharge quantity of 50 mV was measured in constructions of Example 2, and Comparative Examples 4 and 5 in each of which a quaternary ammonium salt was coated on the back surface side of a base material.

(4) Peelability

In the case of the adhesive tape of Example 3, peelability from a glass surface of the tape was recognized after heating at 180°C for 1 hr thereon and no foreign substances derived from an adhesive after peeling-off of the tape was recognized on the glass

surface, whereas in the case of Comparative Example 6, foreign substances derived from the adhesive was recognized on the glass surface after peeling-off of the tape. In each of the cases of Examples 5 and 6, the tape was able to be easily peeled off starting at the projection without breaking the tape, whereas in the case of Comparative Example 7, since cracking occurs at the recessed angular corner at the base of the projection to break the tape, difficulty was encountered in peeling-off the whole of the tape from the projection.

According to results described above, it is possible to provide a surface protective adhesive tape, used in molding a CCD package, suppressing discharge when peeling-off and excellent in heat resistance, visual recognizability and peeling-off resistance.

What is claimed is:

1. A method for mounting an image sensor, wherein in a mounting process of an image sensor using a solid-state imaging device, with an adhesive tape adhered onto a light-receiving portion of the image sensor, the adhesive tape using polyethylene naphthalate as the base material, having a protrusion for peeling on at least part of the periphery thereof, and having an adhesive layer on at least one surface thereof, which adhesive tape has a side part being in parallel to an edge surface of the image sensor and connecting to the bottom of the protrusion, and a lateral part of the adhesive tape connecting from the edge to the bottom of the protrusion having a shape of any one of an oblique line, a zigzag line, a curved line or a combination of these lines, a solder connection reflow of a terminal of the image sensor with a substrate side is performed.

2. The mounting method for an image sensor according to claim 1, wherein not only the adhesive tape covers the entire light receiving section of the image sensor, but also at least one part of the outer periphery is adhered to the light receiving section so as to have a prescribed distance toward the center side from the edge surface of the image sensor.

3. The mounting method for an image sensor according to any one of claims 1 to 3, wherein the adhesive layer is not provided on a portion of the adhesive tape covering the light receiving section of the image sensor.

4. The mounting method for an image sensor according to claim 1, wherein a thermal shrinkage factor at 150°C of the base material used in the adhesive tape is 1.0% or less.

5. The mounting method for an image sensor according to any one of claims 1 to 4, wherein a thermal shrinkage coefficient of the adhesive tape after heating at 180°C for one hour is 1.0% less.

6. The mounting method for an image sensor according to any one of claims 1 to 5, wherein an adhesive force of the adhesive tape after heating at 180°C for one hour is in the range of from 0.1 to 8.0 N/19 mm width.

7. The mounting method for an image sensor according to any one of claims 1 to 6, wherein a light transmittance of the adhesive tape is 50% or more.

8. An adhesive tape used for any one of the methods for mounting an image sensor according to any one of claims 1 to 7, characterized in that the adhesive tape uses polyethylene napthalate as the base material, has a protrusion for peeling on at least part of the periphery thereof, and has an adhesive layer on at least one surface thereof, and also has a side part being in parallel to an edge surface of the image sensor and connecting to the bottom of the protrusion, and a lateral part of the adhesive tape connecting from the edge to the bottom of the protrusion has a shape of any one of an oblique line, a zigzag line, a curved line or a combination of these lines.