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

In recent years, an image sensor using a solid-state image pick-up device has been widely used in applications such as a digital camera and video camera. In a manufacturing process including mounting of an image sensor on the substrate side, there has been a high possibility that damages in an image sensor surface or attachment of dust thereon directly affect image pick-up. Therefore, to cope therewith, an adhesive tape is used as a surface protective tape and the adhesive tape is adhered to the light receiving section side of the image sensor to thereby avoid damages in an image sensor surface or attachment of dust thereon in mounting and a manufacturing process.

In a case where an image sensor is mounted on a substrate or the like, a method has been heretofore adopted in which a soldering iron is used to mount terminals through soldering joint one at a time. Since the number of terminals has been drastically

increased in company with progress in image sensor toward a high image quality and a high functionality, to use a soldering iron and mount the terminals one at a time is tremendously time-consuming which negates practicality. Therefore, a method has been well adopted in which the terminals of an image sensor are in position aligned with a mounting substrate in advance and then, the image sensor and the substrate in this state are put into a solder reflow furnace to connection mount them at one operation.

Necessity arises, however, for the solder reflow furnace to be heated at a high temperature of a melting point of a solder or higher. If an image sensor with an adhesive tape used for protection adhered thereon is heat-reflowed, a base material of an adhesive tape is thermally shrunk to thereby cause position shifts and peeling-off, or a product caused by thermal degradation of the adhesive tape material, to the contrary, by chance, to cause contamination on a surface of an image sensor. A color filter internally used in a solid-state image pick-up device has a possibility of modification or breakage by the action of heat, which makes it impossible to use a reflow treatment especially at a high temperature of 170°C or higher.

Therefore, conventionally, a protective tape is once peeled off immediately before being put into a solder reflow furnace, solder reflow is conducted at a temperature of the order of 160°C and thereafter, a protective tape is again adhered. In this way, it is difficult to pass through a high heating step for solder reflow in a

state where the adhesive tape is adhered.

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 and a surface protective adhesive tape used therefor, capable of applying solder reflow in a state where an adhesive tape is adhered on the light receiving side of the image sensor in a mounting process for an image sensor using a solid-state image pick-up device and protecting the light receiving side of the image sensor even during solder reflow.

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.

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.

According to 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 polyimide film 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, zigzag line, a curved line or a combination of these lines by heating 170°C or higher in the state, a solder connection reflow of a terminal of the image sensor with a substrate side is performed.

According to 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 polyimide film 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.

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 polyimide film as a base material is adhered on the light receiving section side of the image sensor and, by heating 170°C or higher in the state, terminals of the image sensor are connected by solder reflow to a substrate side.

According to example embodiments of the present invention, not only tremendous thermal deformation and shrinkage of an adhesive tape in a high temperature process during solder reflow can be suppressed by a high heat resistance of polyimide, but a heat conduction to a color filter used in a solid-state image pick-up device can also suppressed due to a high light shieldability and a low heat conductivity specific to a polyimide film. Therefore, since the polyimide base material has not only a specific action and effect simply as a heat resistance protective tape but also a specific action and effect suppressing thermal degradation of the color filter inside the solid-state image pick-up device, a heating process at a sufficiently high temperature of 170° or higher can be applied.

In example embodiments of the present invention, the adhesive tape is characterized by that at least silicone material is used as a constituent of an adhesive agent for the adhesive tape.

With such a construction adopted, the adhesive tape can not only increase heat resistance, but also be easier to control of a peel, adhesive force.

In example embodiments, there is provided a mounting method for an image sensor, wherein in a mounting process for an image sensor using a solid-state image pick-up device, an adhesive tape including a polyimide film used as a base material on one surface of which an adhesive layer is provided while on the other surface of which an adhesive tape to which an antistatic agent is coated is adhered on the light receiving section side of the image sensor and in this state, and the image sensor is heated at 170°C or higher to thereby connect terminals of the image sensor to a substrate side by solder reflow.

According to example embodiments of the present invention, it is possible to suppress great thermal deformation or shrinkage of an adhesive tape in a high temperature process during solder reflow, and it is possible to have not only an action and effect to suppress a thermal conduction to a color filter used in a solid-state image pick-up device but also a specific action and effect to suppress thermal degradation of the color filter inside a solid-state image pick-up device in addition to an action and effect simply as a heat resistance protective tape of a polyimide base material, thereby enabling a heating process at a

sufficiently high temperature of 170°C or higher to be conducted.

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.

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, there is provided a mounting method for the image sensor and the mounting method is characterized by that a thermal conductivity of the base material at 170°C is 5×10^{-4} cal/cm sec °C or less.

An image sensor used as a solid-state image pick-up device, in many of cases, includes a color filter and the image sensor, in many of cases, cannot be endure a high temperature in mounting. Since polyimide film as a base material of an adhesive tape of the invention is not only heat-resistant but also low in thermal conductivity, and has a thermal conduction suppressing effect, the film is useful for not only physical protection of an image sensor itself, but also protection of a color filter.

In example embodiments, 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, 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, there is provided an adhesive tape using a polyimide film as

a base material and the adhesive tape is characterized by that the adhesive tape is used in mounting method for any of image sensors described above.

The mounting method requires an adhesive tape with which not only is a surface of an image sensor protected from contamination of foreign matter and suffering damage, but also a part mounting process in a heating condition such as soldering can be conducted without peeling off the adhesive tape. In the invention, by providing a surface protective adhesive tape excellent in heat resistance, thermal shrinkage and adhesive property, such requirements can be met. In addition, generation of static electricity when an adhesive tape is peeled off is suppressed, thereby enabling destruction of an electronic device to be prevented.

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 of an image sensor, high in thermal shrinkage and excellent in heat resistance.

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 embodiments of the invention below.

A mounting method for an image sensor of the invention is such that in a mounting process for an image sensor using a solid-state image pick-up device, terminals of the image sensor are solder reflowed with a substrate side in a state where an adhesive tape using a polyimide film as a base material is adhered to the

light receiving section side of the image sensor. The term "image sensor using a solid-state image pick-up device" stated herein is generally an image sensor using a solid-state image pick-up device called CCD (Charge Coupled Device) or CMOS (Complementary MOS) packaged using a transparent resin, glass material or the like.

The term "light receiving section side" of the image sensor means a front surface side of the sensor receiving an image, a general image sensor is, in most of cases, covered with a transparent resin or glass in order to protect an image pick-up device and actually, the case includes an adhesive tape adhered to a surface of a transparent resin or a cover glass. Though a portion corresponding to at least light receiving section has only to be protected, other portions may also be covered for protection.

An adhesive tape of the invention is basically constituted of a tape base material and an adhesive layer provided on one surface of the base material, while a release film may be adhered to the base material of an adhesive tape. That is, a release film with at least one surface thereof release treated thereon is adhered to the base material with an adhesive layer interposed therebetween, thereby enabling an adhesive layer and thus a surface of an image sensor to be protected. Note that in such a way, it is desirable to peel off the adhesive tape from the mounted image sensor at any stage in manufacturing process to be used.

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.

An adhesive tape to be adhered is necessary to use a polyimide film as a base material. This is because with an adhesive tape for surface protection excellent heat resistance, thermal shrinkage and adhesive property formed, a continuous process can be possible without peeling off the adhesive tape even in the course of part mounting process under heating condition.

No specific limitation is placed on polyimide film referred herein and the film desirably has a thickness of a prescribed value in order to sufficiently exert stiffness as an adhesive tape and a light shielding effect in brown that a polyimide film has. To be concrete, a thickness thereof is preferably 10 μm or more, and more preferably 20 μm or more.

A base material may be made only of a polyimide, and the base material may be a laminate having at least one polyimide film layer and a film containing a polyimide material as raw material. An arbitrary surface treatment or stretching may be applied, or a plasticizer or an additive can be contained therein.

In order to sufficiently exert an effect of thermal conduction suppression to a color filter, a basic material is desirably, for example, a thermal conductivity of 5×10^{-4} cal/cm·sec·°C or less at 170°C. A polyimide film is not only low in heat resistance but also low in thermal conductivity and physically can protect an image

sensor itself and at the same time, can protect a color filter at high temperature in mounting.

No specific limitation is placed on a material of the adhesive agent, and examples thereof include, to be concrete, an acrylic adhesive agent or a silicone adhesive agent. Especially, since a silicone adhesive is not only excellent in heat resistance, but also easy in adjustment of an adhesive force, an adhesive force when the adhesive tape is peeled off after the mounting is finally completed is arbitrarily adjusted and a design of an adhesive tape excellent in handling can be realized, which can be said to be an especially suitable adhesive material.

In the invention, a mounting method thereof is characterized by that terminals of an image sensor are connected by solder reflow to the substrate side by heating at 170°C or higher. This shows mounting using solder reflow using a reflow furnace and to be concrete, the maximum temperature during the treatment in a reflow furnace has only to be 170°C or higher.

A thickness of adhesive layer of adhesive tape is in the range of from 1 μm or more and 100 μm or less, preferably in the range of from 3 μm or more and 50 μm or less, and more preferably in the range of from 5 μm or more and 30 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 100 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.

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.

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.

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) State of Glass Surface after Peeling-off the Tape

A state of glass surface after tape was peeled off was visually observed.

(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 samples from the following examples and the comparative examples were adhered on a surface glass of a CCD package, and the samples are put into a solder reflow furnace in conditions of the highest temperature of 180°C × 5 sec (a time in the reflow furnace including a preheating was about 90 sec) to thereby conduct mounting to the substrate, followed by evaluation of easiness of peeling-off.

<Example 1>

A silicone adhesive agent (SD-4580, manufactured by Dow Corning Toray Co., Ltd.) was coated on a polyimide film (Capton 100H, manufactured by Toray DuPont Co., Ltd. with a thickness of 25 μm and a thermal conductivity of about 4.1×10^{-4} cal/cm·sec·°C at 170°C) to a thickness of 10 μm, an adhesive tape was fabricated, and the adhesive tape was adhered to a surface glass of a CCD package. The adhesive tape on the surface glass was put into a solder reflow furnace in conditions of the highest temperature of 180°C × 5 sec (a time in the reflow furnace including preheating is about 90 sec) to thereby conduct mounting to a substrate. The

adhesive tape was peeled off after mounting was completed.

As a result, neither damage nor attached foreign matter was confirmed on a surface after the adhesive tape was peeled off, and normal workings as CCD were confirmed.

<Example 2>

A quaternary ammonium salt (NR-121X, manufactured by Colcoat Co., Ltd.) was coated on the back surface side of a base material made of polyimide with a thickness of 25 μm (Capton 100H, manufactured by Toray DuPont Co., Ltd.). Thereafter, a solution of an acrylic adhesive agent was coated on the other surface thereof and the wet coat was dried to form an adhesive layer of a thickness of 10 μm and to thereby fabricate an adhesive tape.

After the adhesive tape was heated at 180°C for one hr, an adhesive force was measured according to JIS Z 0237 to obtain 2.5 N/19 mm and a thermal shrinkage coefficient was 0.1%. No peeling off of the adhesive tape was confirmed and the maximum value of a discharge quantity was 50 mV.

<Example 3>

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. The adhesive tape was adhered to a surface glass of a CCD package and in a similar way to

that in Example 1, put into a solder reflow furnace at 180°C to thereby conduct mounting to a substrate.

Thereafter, the adhesive tape was peeled off from the projection using a projection of the tape and the adhesive tape was easily peeled off without breakage of the tape. Neither damage nor attached foreign matter was confirmed on a glass surface of the CCD package after the tape was peeled off and normal workings as the CCD were confirmed.

<Example 4>

An adhesive tape similar to that in Example 2 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. The adhesive tape was adhered to a surface glass of a CCD package and in a similar way to that in Example 1, put into a solder reflow furnace at 180°C to thereby conduct mounting to a substrate.

Thereafter, the adhesive tape was peeled off from a projection of the tape and the tape was easily peeled off from the projection without breaking the adhesive tape. Neither damage nor attached foreign matter was confirmed on a glass surface of the CCD package after the adhesive tape was peeled off and normal workings as the CCD were confirmed.

<Comparative Example 1>

Comparative Example 1 was conducted in a similar way to that in Example 1 with the exception that a rubber adhesive agent with a storage elastic modulus of $2.0 \times 10^3 N/cm^2$ was coated on a Nylon film with a thickness of 25 μm (6 Nylon, a thermal conductivity of about 5.5×10^{-4} cal/cm·sec·°C, manufactured by TORAY INDYSTRIES, INC.) to a thickness of 10 μm.

As a result a positional shift occurs in an adhered portion by thermal shrinkage of the adhesive tape and the thermally degraded adhesive agent remained on and contaminated an exposed surface by peeling-off. The CCD itself does not work normally, since a color filter in the CCD could be failed due to a temperature of reflow, which was not sure.

<Comparative Example 2>

An adhesive tape was obtained in a similar way to that in Example 2 with the exception that no quaternary ammonium salt was coated 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 2.5 N/19 mm and a thermal shrinkage was 0.1%. No peeling-off of the adhesive tape was confirmed but a discharge of 400 mV was confirmed.

<Comparative Example 3>

An adhesive tape was obtained in a similar way to that in Example 2 with the exception that a quaternary ammonium salt

was coated on the back surface 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 2.5 N/19 mm and a thermal shrinkage was 0.1%. No peeling-off of the adhesive tape was confirmed but a discharge of 350 mV was confirmed.

<Comparative Example 4>

An adhesive tape similar to that of Example 4 was fabricated with the exception that side portions of a projection is each in the shape of a base with a right angle (A shape 3e as shown with a broken line of Fig. 2(A)). The adhesive tape was adhered to a surface glass of a CCD package and the adhesive tape on the surface glass was, in a similar way to that in Example 1, put into a solder reflow furnace at 180°C to thereby conduct mounting to a substrate.

Thereafter, the adhesive tape was peeled off using a projection of the tape and cracking occurred at the portion with a right angle at the base of the projection to break the adhesive tape, thereby having disabled the whole of the adhesive tape to be peeled off with ease from the projection.

<Reference Example 1-1>

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 agent 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. No peeling-off of the adhesive tape was confirmed but the maximum discharge of 350 mV was confirmed.

<Reference Example 1-2>

An adhesive tape was obtained in a similar way to Reference Example 1-1 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. No peeling-off of the adhesive tape was confirmed but a discharge of 400 mV was confirmed.

<Reference Example 1-3>

An adhesive tape was obtained in a similar way to Reference Example 1-1 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. The maximum discharge was 50 mV and floating was observed at the end surface of the adhesive tape.

<Reference Example 2-1>

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%. A shape of the adhesive tape after the heating was such that neither floating nor peeling-off of the adhesive tape from a glass surface was observed.

<Reference Example 2-2>

An adhesive tape was obtained in a similar way to Reference Example 2-1 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%. After the heating, a foreign matter originated from an adhesive agent was confirmed on a glass surface after the adhesive tape was peeled off.

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, workability 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 polyimide film 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, by heating 170°C or higher in the state, 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 claims 1 or 2, wherein at least silicone material is used as a constituent of an adhesive agent for the adhesive tape.

4. 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.

5. The mounting method for an image sensor according to any of claims 1 to 4, wherein a thermal conductivity of the base material at 170°C is 5×10^{-4} cal/cm-sec-°C or less.

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

7. The mounting method for an image sensor according to any one of claims 1 to 6, 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.

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 polyimide film 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.