

PROCESS FOR PRODUCING SEMICONDUCTOR DEVICES, AND HEAT RESISTANT ADHESIVE TAPE USED IN THIS PROCESS

FIELD OF THE INVENTION

The present invention relates to a process for producing semiconductor devices, using a metal lead frame onto which a heat resistant adhesive tape is bonded; and a heat resistant adhesive tape used in this process.

BACKGROUND OF THE INVENTION

In recent years, attention has been paid to CSP (Chip Size/Scale Package) techniques about LSI-mounting techniques. Of these techniques, a package in which lead terminals are taken, a typical example of which is a QFN (Quad Flat Non-leaded package), is one package form to which especial attention is paid from the viewpoints of its small size and a high integration degree of elements mounted therein. Of processes for producing such QFNs, in recent years, attention has been particularly paid to a process of arranging plural QFN chips, in good order, on die pads in package pattern areas of a lead frame, sealing the resultant with a sealing resin at a time inside cavities made in a mold, then cutting and dividing the resultant package into individual QFN structures, thereby improving the productivity of semiconductor devices per unit area of the lead frame largely.

In such a process for producing QFNs, wherein plural

semiconductor chips are collectively sealed, the area clamped with a molding die when the chips are sealed with a resin is only an area outside its resin-sealed area which is spread to the outside of its package pattern areas. Accordingly, in the package pattern areas, in particular, the central area thereof, the outer lead faces of the QFNs cannot be pressed onto the molding die with a sufficient pressure. As a result, it is very difficult to restrain the sealing resin from leaking out toward the outer lead side. Thus, a problem that terminals or others of the QFNs are coated with the resin is easily caused.

It is effective against problems as described above to adopt a QFN-producing process of bonding an adhesive tape onto the outer lead side of a lead frame, and then making use of sealing effect using self-bonding power (masking) of this adhesive tape to prevent a resin from leaking out toward the outer lead side at the time of sealing with the resin.

In such a production process, it is substantially difficult from a handling viewpoint to mount semiconductor chips on a lead frame or carry out wire bonding and subsequently bond, onto the resultant, a heat resistant adhesive tape. It is therefore desired that a heat resistant adhesive tape is bonded onto the outer pad surface of a lead frame at the initial stage and the tape is being bonded thereon all the time from this time through the steps of mounting semiconductor chips and carrying out wire bonding to the step of sealing the resultant with a resin. As this process, suggested is a production

process of using a heat resistant adhesive tape having a pressure-sensitive adhesive layer of 10 μm or less thickness to carry out a series of steps, such as wire bonding, while preventing resin-leakage (see JP-A-2002-184801).

In this production process, the heat resistant adhesive tape is peeled at any time after the sealing step. However, if the adhesive tape is an adhesive tape having a very strong adhesive force, the peeling becomes difficult. Moreover, the molded resin may be peeled or damaged by stress resulting from the peeling as the case may be. Thus, it is not preferred that the adhesive tape has a larger adhesive force than the adhesive force necessary for suppressing the leakage of the used sealing resin.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a process for producing semiconductor devices wherein resin-leakage in a sealing step is appropriately prevented by a heat resistant adhesive tape while the stuck tape causes no troubles in any step after the sealing step.

Another object of the invention is to provide an adhesive tape for producing semiconductor devices, which is used in the above-mentioned semiconductor device producing process.

In order to attain the above-mentioned objects, the inventors have made eager investigations about physical properties, raw materials and others of heat resistant adhesive tapes so as to find

out that the above-mentioned objects can be attained by using a heat resistant adhesive tape comprising an adhesive component to which a mold release agent component is added. As a result, the present invention has been made.

Thus, the present invention relates to a process for producing semiconductor devices, comprising, at least, a mounting step of bonding semiconductor chips onto die pads of a metal lead frame having, on its outer pad side, a heat resistant pressure-sensitive adhesive tape, a sealing step of sealing the semiconductor chip side of the lead frame with a sealing resin to yield a sealed structure, and a cutting step of cutting the sealed structure into the semiconductor devices, which are individually separated,

wherein the heat resistant adhesive tape comprises, at least, a base layer and a pressure-sensitive adhesive layer containing a mold release agent.

In the process for producing the semiconductor devices, it is preferable that the adhesive force of the heat resistant adhesive tape according to JIS Z 0237 is 5.0 N/19-mm-width or less after the heat resistant adhesive tape stuck on a stainless steel plate is heated at 200°C for 1 hour. The adhesive force is measured at room temperature (23°C).

The present invention also relates to a heat resistant adhesive tape used in a process for producing semiconductor devices, comprising, at least, a mounting step of bonding semiconductor chips onto die pads of a metal lead frame having, on its outer pad

side, the heat resistant adhesive tape stuck, a sealing step of sealing the semiconductor chip side of the lead frame with a sealing resin to yield a sealed structure, and a cutting step of cutting the sealed structure into the semiconductor devices, which are individually separated, wherein the heat resistant adhesive tape comprises, at least, a base layer and a pressure-sensitive adhesive layer containing a mold release agent.

The heat resistant adhesive tape of the present invention can suitably prevent resin-leakage in the sealing step, and further the tape can easily be peeled after the sealing step since the pressure-sensitive adhesive layer contains the mold release agent. Thus, the molded resin can be restrained from being peeled or damaged by peeling stress

In the case that the adhesive force of the heat resistant adhesive tape according to JIS Z 0237 is 5.0 N/19-mm-width or less after the heat resistant adhesive tape stuck on a stainless steel plate is heated at 200°C for 1 hour, adhesive force necessary for preventing resin-leakage in the sealing step can surely be obtained. Additionally, the heat resistant adhesive tape is easily peeled after the sealing step so that the sealing resin is not damaged. The adhesive force is more preferably 2.0 N/19-mm-width or less. If the adhesive force is more than 5.0 N/19-mm-width or more, the adhesive force between the pressure-sensitive adhesive layer and the lead frame or the sealing resin is strong. Consequently, when the pressure-sensitive adhesive layer is forcibly peeled, a surface layer of

the pressure-sensitive adhesive layer remains on the completed packages. Thus, the packages are not good packages. The adhesive force is preferably 0.05 N/19-mm-width or more, more preferably 0.1 N/19-mm-width or more in order to prevent resin-leakage in the sealing step suitably.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and superior points of the present invention will be sufficiently understood from the following description. The advantages of the present invention will be made clear from the following description with reference to the attached drawings.

Figs. 1(a) to 1(e) are process charts illustrating an example of the process for producing semiconductor devices of the present invention.

Figs. 2(a) to 2(c) are views illustrating an example of a lead frame in the present invention, wherein Fig. 2(a) is a front view thereof, Fig. 2(b) is an enlarged view of a main portion thereof, and Fig. 2(c) is a bottom view illustrating the lead frame subjected to a resin-sealing step.

Fig. 3 is a vertical sectional view illustrating an example of the resin-sealing step in the present invention.

DESCRIPTION OF THE EMBODIMENTS

Embodiments of the invention are described with reference to

the drawings hereinafter. Figs. 1(a) to 1(e) are process charts illustrating an example of the process for producing semiconductor devices of the present invention.

As illustrated in Figs. 1, the semiconductor device producing process of the invention comprises the step of mounting semiconductor chips 15, the step of sealing the chips with a sealing resin 17, and the step of cutting a sealed structure 21.

As illustrated in Figs. 1(a) and 1(b), the mounting step is a step of bonding semiconductor chips 15 on die pads 11c of a metal lead frame 10 having, onto an outer pad side thereof (on the lower side in the figure), a bonded heat resistant adhesive tape 20.

The lead frame 10 is a member made of a metal, such as copper, wherein terminal patterns of QFNs are engraved. Electric contacts thereof may be coated (or plated) with a material such as silver, nickel, palladium, or gold. The thickness of the lead frame 10 is generally from 100 to 300 μm . This is not applied to a lead frame which is partially thinly worked by etching or the like.

The lead frame 10 is preferably a lead frame wherein sites for individual QFNs are arranged in good order so as to be easily cut in the cutting step, which is performed later. For example, as illustrated in Figs. 2, the form in which sites for QFNs are arranged in a matrix form on the lead frame 10 is called a matrix QFN or MAP-QFN, and is one of the most preferable lead frame forms. In particular, in order to make the number of packages arranged in one lead frame larger from the viewpoint of productivity in recent years,

each of these packages has been made minuter. Moreover, in order to seal a larger number of packages in one sealing region, the number of the packages has also been made larger.

As illustrated in Figs. 2(a) and 2(b), in each package pattern area 11 of the lead frame 10, substrate designs for QFNs wherein plural terminal portions 11b are arranged toward each of adjacent openings 11a are arranged in good order. In the case that the QFNs are ordinary QFNs, each substrate design (i.e., each area divided into a lattice form in Fig. 2(a)) is composed of one of the terminal portions 11b which is arranged around one of the openings 11a and has, on the lower side thereof, an outer lead face; a die pad 11c arranged at the center of the opening 11a; and die bars 11d for supporting the die pad 11c to four corners of the opening 11a.

The heat resistant adhesive tape 20 is bonded onto the outside of the package pattern areas 11, and is preferably bonded onto an area including the whole of the outer circumference of a resin sealing area, which is to be sealed with a resin. The lead frame 10 usually has, near a side thereof, holes 13 for guide pins for attaining positioning at the time of resin-sealing. The heat resistant adhesive tape 20 is preferably bonded to the lead frame so as not to cover the holes 13. Since the resin sealing areas are arranged in the longitudinal direction of the lead frame 10, the adhesive tape 20 is preferably bonded in such a manner that one piece of the tape 20 extends over the areas.

Semiconductor chips 15, that is, silicon wafer chips, which

are semiconductor integrated circuit members, are mounted on the lead frame 10. The die pads 11c, which are fixing areas for fixing the semiconductor chips 15, are arranged on the lead frame 10. The method for bonding the chips onto the die pads 11c may be any one selected from various methods, such as a method of using an electroconductive paste 19, a method of using an adhesive tape, and a method of using an adhesive. In the case that the die-bonding is performed by use of an electroconductive paste, thermosetting adhesive or the like, the paste or the like is generally heated and cured at a temperature of about 150 to 200°C for about 30 to 90 minutes.

Subsequently, a bonding step is generally performed wherein tips of the terminal portions of the lead frame are electrically connected to electrode pads on the semiconductor chips with bonding wires. As illustrated in Fig. 1(c), the bonding step is a step of connecting tips of the terminal portions 11b (inner leads) of the lead frame 10 electrically to electrode pads 15a on the semiconductor chips 15 with bonding wires 16. The bonding wires 16 may be, for example, gold lines or aluminum lines. In general, the wire bonding is performed by use of both of vibration energy based on ultrasonic waves and compressing energy based on applied pressure in the state that the wires are heated at 120 to 250°C. At this time, the surface of the heat resistant adhesive tape 20 attached to the lead frame 10 is subjected to vacuum-suction, wherein the lead frame 10 can surely be fixed to a heat block. The above has

described a case in which the semiconductor chips are subjected to facing-up mounting followed by the wire bonding step. However, in the case that the semiconductor chips are subjected to facing-down mounting, a reflow step is appropriately performed.

As illustrated in Fig. 1(d), the above-mentioned sealing step is a step of sealing the semiconductor chip side of the lead frame with a sealing resin 17. The sealing step is performed to protect the semiconductor chips 15 mounted on the lead frame 10 and the bonding wires 16, and is typically performed by molding the sealing resin 17, such as epoxy resin, in a mold. At this time, as illustrated in Fig. 3, as the mold, there is generally used a mold 18 which has an upper mold part 18a and a lower mold part 18b, both having plural cavities, so as to seal the semiconductor chips with plural lumps of the sealing resin 17 at a time, thereby yielding a sealed structure 21. Specifically, the heating temperature for the resin-sealing is, for example, from 170 to 180°C. The resin is cured at this temperature for several minutes, and then subjected to post-mold-curing for several hours. The heat resistant adhesive tape 20 is preferably peeled before the post-mold-curing.

As illustrated in Fig. 1(e), the above-mentioned cutting step is a step of cutting the sealed structure 21 into individual semiconductor devices 21a. The cutting step is generally a step of using a rotary cutting blade such as a dicer to cut cutting-regions 17a of the sealing resin 17.

The heat resistant adhesive tape 20 of the present invention

has at least a base layer and a pressure-sensitive adhesive layer comprising a mold release agent.

The heat resistant adhesive tape 20 is heated in the above-mentioned production process since the tape 20 is beforehand bonded to the lead frame 10. For example, when the semiconductor chips 15 are die-bonded, the tape 20 is generally heated and cured at a temperature of about 150 to 200°C for 30 to 90 minutes. The wire bonding is performed at a temperature of, e.g., 120 to 250°C. In the case that many semiconductor devices are produced from a single lead frame, heating is performed during a period till the bonding of all the semiconductor devices ends. Thus, the heating may require one or more hours per lead frame. When resin-sealing is performed, a temperature of about 175°C is required since the resin needs to be heated at a temperature at which the resin is sufficiently melted. Accordingly, the base layer of the heat resistant adhesive tape 20 should be made of a material satisfying heat resistance against such heating conditions.

The material of the base layer may be a resin material such as polyethylene terephthalate (PET) film, polyethylene naphthalate (PNT) film, polyethylenesulfone (PES) film, polyetherimide (PEI) film, polysulfone (PSF) film, polyphenylenesulfide (PPS) film, polyetheretherketone (PEEK) film, polyarylate (PAR) film, aramide film, or liquid crystal polymer (LCP).

The thickness of the base layer of the heat resistant adhesive tape 20 is preferably 5 μm or more in order to prevent the tape from

being folded or broken, and is more preferably from 10 to 100 μm in light of a suitable handlability thereof.

The adhesive which constitutes the pressure-sensitive adhesive layer is not limited to any especial kind, as long as the adhesive has appropriate heat resistance. Examples thereof include rubber type, acrylic type and silicone type adhesives.

The acrylic type adhesive, which is one of such adhesive components, may be an acrylic polymer made from: a main monomer having a low glass transition temperature (T_g) to give viscosity; a comonomer having a high T_g to give adhesive property and cohesive force; a monoethylenic unsaturated monomer such as a monomer containing a functional group for crosslinking or an improvement in the adhesive property and so on. Examples of the main monomer include alkyl (meth)acrylates such as 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, and dodecyl (meth)acrylate.

Examples of the comonomer include vinyl-containing compounds such as vinyl acetate, vinyl propionate, vinyl ether, styrene, acrylonitrile, and methacrylonitrile. Examples of the functional group containing monomer include carboxyl-containing monomers such as acrylic acid, methacrylic acid, crotonic acid, maleic acid, fumaric acid, and itaconic acid; hydroxyl-containing monomers such as 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl

(meth)acrylate, 4-hydroxybutyl (meth)acrylate, N-methylolacrylamide, and allyl alcohol; tertiary amino containing monomers such as dimethylaminoethyl (meth)acrylate, diethylaminoethyl (meth)acrylate, and dimethylaminopropyl (meth)acrylate; amide-containing monomers such as acrylamide and methacrylamide; N-substituted amide containing monomers such as N-methyl(meth)acrylamide, N-ethyl(meth)acrylamide, N-methoxymethyl(meth)acrylamide, N-ethoxymethyl(meth)acrylamide, N-t-butylacrylamide, and N-octylacrylamide; and epoxy-containing monomers such as glycidyl methacrylate.

These acrylic type adhesives may appropriately contain a crosslinking agent. Examples thereof include isocyanate, epoxy, aziridine, and chelate crosslinking agents. The amount of the crosslinking agent to be used is not particularly limited. However, in the case that the whole of the pressure-sensitive adhesive layer is too soft, it is feared that even if bonding wires are bonded thereto at the time of wire bonding, the elastic force of the pressure-sensitive adhesive layer hinders sufficient fixation of the lead frame based on the bonding of the adhesive tape to the frame so that compressing energy based on applied pressure is relieved to result in bonding poorness. The amount of the crosslinking agent to be used is preferably from 0.1 to 15 parts by weight, more preferably from 1.0 to 10 parts by weight for 100 parts by weight of the acrylic polymer. Such an acrylic type adhesive is the most preferable adhesive for the

present invention since the adhesive easily gives an appropriate adhesive force or storage elastic modulus.

The above-mentioned pressure-sensitive adhesive layer contains a mold release agent. The mold release agent is not limited to any especial kind, as long as the agent exhibits an ordinary releasing effect. Examples thereof include long chain alkyl containing polymer, silicone polymer, perfluoro polymer, and fluorinated polyolefin, which are used as peeling liners; and polyethylene wax, carnauba wax, montanoic acid, and stearic acid, which are known as mold release agents for plastic material. Of these, polyethylene wax is preferable, and oxidized polyethylene wax is particularly preferable. A different example of the mold release agent is a plasticizer. The plasticizer is not limited to any especial kind, as long as the plasticizer generally causes the adhesive force of the adhesive agent onto an object to be lowered. Examples thereof include trimellitic acid esters, pyromellitic acid esters, phthalic acid esters, and adipic acid esters.

The amount of the mold release agent to be added is not particularly limited, and is appropriately decided so as to obtain releasing effect dependently on an object on which the pressure-sensitive adhesive layer is to be bonded. Additionally, the amount is controlled so as not to be excessive, that is, so as not to damage the adhesive function of the pressure-sensitive adhesive layer remarkably. For example, the amount is usually from 0.1 to 5 parts by weight, preferably from 0.1 to 3 parts by weight, and more

preferably from 0.1 to 1 part by weight for 100 parts by weight of the above-mentioned acrylic polymer. These ranges are standards, and the amount of the mold release agent is desirably adjusted dependently on the peeling force of the pressure-sensitive adhesive layer. These ranges are suitable particularly for oxidized polyethylene type mold release agents. When the plasticizer is added to the pressure-sensitive adhesive layer, the amount thereof is usually from 5 to 50 parts by weight, preferably from 10 to 50 parts by weight, more preferably from 20 to 40 parts by weight. These ranges are also standards, and the amount of the plasticizer is desirably adjusted dependently on the peeling force of the pressure-sensitive adhesive layer.

In the present invention, these mold release agents may be used alone or in combination. If necessary, as other additives, various additives may be added to the pressure-sensitive adhesive layer. Examples thereof include an ultraviolet absorber, a tackifier, a softener (plasticizer), a filler, an age resistor, a pigment, a dye, and a silane coupling.

It is preferable that the pressure-sensitive adhesive layer, which constitutes the adhesive tape 20, has a certain measure of elasticity from a viewpoint of adhesive function. However, in the case that the whole of the pressure-sensitive adhesive layer is too soft, it is feared that even if bonding wires are bonded thereto at the time of wire bonding, the elastic force of the pressure-sensitive adhesive layer hinders sufficient fixation of the lead frame onto

which the adhesive tape is bonded so that compressing energy based on applied pressure is relieved to result in bonding poorness.

In order to ensure conflictive performances that such bonding poorness is not caused and further adhesive force sufficient for preventing resin-leakage in the sealing step is kept, the shear storage elastic modulus of the pressure-sensitive adhesive layer, which is measured at a frequency of 1 Hz and a temperature-rising rate of 5°C/minute with a viscoelastic spectrometer, is preferably set to 1.0×10^4 Pa or more, more preferably 1.0×10^5 Pa or more at 200°C since the cushion property of the whole of the pressure-sensitive adhesive layer can be kept slight so that wire bonding strength can be obtained. If the storage elastic modulus is too large, the property that the adhesive tape follows steps of a lead frame tends to lower. As a result, it is feared that a sealing resin may bleed when the resin is molded. Thus, the storage elastic modulus is preferably 1×10^8 Pa or less.

The thickness of the pressure-sensitive adhesive layer in the invention is not particularly limited. However, a very large thickness is not preferred in order to keep the cushion property of the whole of the pressure-sensitive adhesive layer slight when this layer undergoes a wire bonding step. On the other hand, it is necessary for the pressure-sensitive adhesive layer to have a certain measure of thickness in order to exhibit a sufficient sealing power as well when this layer undergoes a sealing step. The thickness of the pressure-sensitive adhesive layer which makes it possible to attain

such conflictive properties with good balance is preferably from about 1 to 50 μm , more preferably from 5 to 25 μm .

The following describes working examples and so on, which specifically illustrate the present invention and advantageous effects thereof.

Example 1

A polyimide film (KAPTON 100H, manufactured by Toray Du Pont) of 25 μm thickness was used as a basic material. Separately, an acrylic copolymer containing, as constituent monomers, 5 parts by weight of acrylic acid per 100 parts by weight of butyl acrylate was used to prepare an acrylic type adhesive wherein 3 parts by weight of an epoxy crosslinking agent (Tetrad-C, manufactured by Mitsubishi Ga Chemical Co., Inc.) and 0.2 part by weight of oxidized polyethylene wax (Licowax PED 521, manufactured by Clariant Japan, acid value: 15-19 mg KOH/g) as a mold release agent were added to 100 parts by weight of the above-mentioned acrylic copolymer. This acrylic type adhesive was used to form a heat resistant adhesive tape on which a pressure-sensitive adhesive layer of 10 μm thickness was formed. A device (ARES, manufactured by Rheometric Scientific Co.) was used in a shear storage elastic mode using parallel plates (sample size: 7.9 mm in diameter) to measure the storage elastic modulus of this acrylic type adhesive at 200°C. The frequency used at this time was 1 Hz, and the temperature-rising rate was 5°C/second. As a result, the storage elastic modulus was 9.0×10^5 Pa at 200°C. This adhesive tape was bonded to a stainless

steel plate and then the tape was heated at 200°C for 1 hour in this state. Thereafter, the adhesive force thereof was measured according to JIS Z 0237. The adhesive force was 0.2 N/19-mm-width.

This heat resistant adhesive tape was stuck onto the outer pad side of a copper lead frame wherein 4×4 QFNs (i.e., 16 QFNs), each of which was subjected to Ni/Pd plating and flash Au plating and had 16 pins along each side thereof were arranged. Semiconductor chips were bonded to die-pad portions of this lead frame with an epoxy phenol type silver paste, and then the paste was cured at 180°C for 1 hour to fix the chips.

Next, the lead frame was vacuum-sucked from its heat resistant adhesive tape side so as to be fixed onto a heat block heated to 200°C. Furthermore, the peripheral portion of the lead frame was pressed and fixed with a wind clumper. A 115-KHZ wire bonder (UTC-300 BIsuper, manufactured by Shinkawa Ltd.) was used to subject the fixed lead frame to wire bonding by use of gold lines of 25 μm diameter (GMG-25, manufactured by Tanaka Kikinzoku Kogyo K.K.) under the following conditions. The bonding was finished in about 1 hour.

First bonding applied-pressure: 80 g

First bonding ultrasonic strength: 550 mW

First bonding time: 10 msec

Second bonding applied-pressure: 80 g

Second bonding ultrasonic strength: 500 mW

Second bonding time: 8 msec

A molding machine (Model-Y-series, manufactured by Towa) was used to mold an epoxy sealing resin (HC-300B6, manufactured by Nitto Denko K.K.) onto the above-mentioned chips subjected to the wire bonding at 175°C for the following time conditions: a pre-heating time of 3 seconds, an injection time of 12 seconds, and a curing time of 90 seconds. Thereafter, the heat resistant adhesive tape was peeled. The resultant was then subjected to post-mold-curing at 175°C for 3 hours to cure the resin sufficiently. Thereafter, the resultant structure was cut with a dicer to yield individual QFN type semiconductor devices.

In the thus-obtained QFNs, the adhesive tape was able to be easily peeled without leaving any paste. The masking performance thereof for restraining the sealing resin from being forced out was also good. The completed packages were good packages wherein particularly conspicuous adhering contaminants were not recognized.

Example 2

An acrylic type adhesive was prepared in the same way as in Example 1 except that 20 parts by weight of a trimellitic acid ester (W-700, manufactured by Dainippon Ink & Chemicals, Inc.) were added instead of the above-mentioned mold release agent (plasticizer). This acrylic type adhesive was used to form a heat resistant adhesive tape in the same way as in Example 1 and produce QFNs in the same way as in Example 1. In the thus-obtained QFNs,

the adhesive tape was able to be easily peeled without leaving any paste. The masking performance thereof for restraining the sealing resin from being forced out was also good. The completed packages were good packages wherein particularly conspicuous adhering contaminants were not recognized. The storage elastic modulus of the acrylic type adhesive, which was measured in the same manner as in Example 1, was 7.0×10^5 Pa, and the adhesive force of the adhesive tape was 0.5 N/19-mm-width.

Comparative Example 1

Semiconductor chips were bonded onto a lead frame only, onto which no heat resistant adhesive tape was stuck, and then the resultant was sandwiched between mold parts and sealed with a resin under the same conditions as in Example 1. As a result, the resin leaked out.

Comparative Example 2

An acrylic type adhesive was prepared in the same way as in Example 1 except that no mold release agent was added. This acrylic type adhesive was used to form a heat resistant adhesive tape in the same way as in Example 1 and produce QFNs in the same way as in Example 1. Each of the thus-obtained QFNs had good masking performance for restraining the sealing resin from being forced out. However, the adhesive force of the adhesive tape therein was remarkably high. Thus, when the tape was forcibly peeled, a surface layer of the pressure-sensitive adhesive layer remained on the completed package. The storage elastic modulus of the acrylic type

adhesive, which was measured in the same manner as in Example 1, was 9.0×10^5 Pa, and the adhesive force of the adhesive tape was 7.5 N/19-mm-width.

The specific embodiments and examples described in the item "DESCRIPTION OF THE EMBODIMENTS" are merely embodiments and examples for making the technical content of the present invention clear. Thus, the invention should not be interpreted in a narrow sense so as to be limited to such specific examples. The invention can be modified within the scope of the spirit of the invention and the following claims.

CLAIMS:

1. A process for producing semiconductor devices, comprising a mounting step of bonding semiconductor chips onto die pads of a metal lead frame having, on its outer pad side, a heat resistant pressure-sensitive adhesive tape, a sealing step of sealing the semiconductor chip side of the lead frame with a sealing resin to yield a sealed structure, and a cutting step of cutting the sealed structure into the semiconductor devices, which are individually separated,

wherein the heat resistant adhesive tape comprises a base layer and a pressure-sensitive adhesive layer containing a mold release agent.

2. The process for producing the semiconductor devices according to claim 1, wherein the adhesive force of the heat resistant adhesive tape according to JIS Z 0237 is 5.0 N/19-mm-width or less after the heat resistant adhesive tape stuck on a stainless steel plate is heated at 200°C for 1 hour.

3. A heat resistant adhesive tape used in a process for producing semiconductor devices, comprising a mounting step of bonding semiconductor chips onto die pads of a metal lead frame having, on its outer pad side, the heat resistant adhesive tape stuck, a sealing step of sealing the semiconductor chip side of the lead

frame with a sealing resin to yield a sealed structure, and a cutting step of cutting the sealed structure into the semiconductor devices, which are individually separated,

wherein the heat resistant adhesive tape comprises a base layer and a pressure-sensitive adhesive layer containing a mold release agent.

4. The heat resistant adhesive tape according to claim 3, which has an adhesive force according to JIS Z 0237 of 5.0 N/19-mm-width or less after the heat resistant adhesive tape stuck on a stainless steel plate is heated at 200°C for 1 hour.