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Electronic component accommodation package and electronic device

Abstract

Disclosed is an electronic component accommodation package, including: a substrate that has an upper surface including a mounting area; and a frame that is on the upper surface of the substrate to surround the mounting are. The frame includes: a first frame that contains a ceramic material; a second frame that has a through hole and that contains a metal material; and a third frame that contains a metal material. The first frame includes a first end and a second end, and the second frame includes a third end and a fourth end. The first end of the first frame and the fourth end of the second frame are joined to each other via a joining material, and the second end of the first frame and the third end of the second frame are joined to each other via a joining material.

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Background/Summary

TECHNICAL FIELD

(1) The present disclosure relates to an electronic component accommodation package for

accommodating an electronic component, and an electronic device.

BACKGROUND ART

(2) In recent years, airtightness of sealing has been required for electronic component accommodation packages that accommodate electronic components such as ICs (Integrated Circuits), LSIs (Large-Scale Integrations), power devices, light emitting diodes, piezoelectric elements and quartz oscillators, and electronic devices (see JP-A-2010-62181).

(3) In the package described in JP-A-2010-62181, thermal deformation may cause a tilt in the vertical direction or input/output terminals and the like to be subjected to a load.

SUMMARY

(4) An electronic component accommodation package according to an embodiment of the present disclosure includes: a substrate that has an upper surface including an mounting area on which an electronic component is to be mounted; a frame that is on the upper surface of the substrate to surround the mounting area and that has a through hole that penetrates the frame outward from the mounting area in a plan view. The frame includes: a first frame that is on the upper surface of the substrate to surround at least a part of the mounting area and that contains a ceramic material; a second frame that is on the upper surface of the substrate to surround at least a part of the mounting area, that has the through hole, and that contains a metal material; and a third frame that is on an upper surface of the first frame and an upper surface of the second frame to surround the mounting area in a plan view and that contains a metal material. The first frame incudes a first end and a second end, and the second frame includes a third end and a fourth end. The first end of the first frame and the fourth end of the second frame are joined to each other via a joining material, and the second end of the first frame and the third end of the second frame are joined to each other via a joining material.

(5) The electronic device according to an embodiment of the present disclosure includes: the above-described electronic component accommodation package; an electronic component mounted on the mounting area; and a lid that covers the electronic component and that is bonded on an upper surface of the third frame via an adhesive.

Description

BRIEF DESCRIPTION OF DRAWINGS

(1) FIG. **1** is an overall perspective view of an electronic component accommodation package according to an embodiment of the present disclosure.

(2) FIG. **2** is a top view of the electronic component accommodation package according to the embodiment of the present disclosure.

(3) FIG. **3** is a side view of the electronic component accommodation package according to the embodiment of the present disclosure.

(4) FIG. **4** is an exploded perspective side view of the electronic component accommodation package according to the embodiment of the present disclosure.

(5) FIG. **5** is an overall perspective view of an electronic device according to an embodiment of the present disclosure.

(6) FIG. **6** is an enlargement of X in FIG. **3**.

DESCRIPTION OF EMBODIMENTS

(7) Hereinafter, an electronic component accommodation package **1** and an electronic device **10** according to an embodiment of the present invention will be described referring to the drawings.

(8) <Electronic Component Accommodation Package and Electronic Device>

(9) First, the electronic component accommodation package **1** (hereinafter referred to as the package **1**) will be described referring to FIG. **1** to FIG. **4** and FIG. **6**.

(10) The package **1** is used for accommodating an element composed of a passive element. Such

elements include, for example, active elements such as semiconductor elements, transistors, diodes and thyristors, resistors, capacitors, solar cells, piezoelectric elements, crystal oscillators, ceramic oscillators, and the like. More specifically, the package **1** is suitable for an element compatible with high voltage, large current, high speed and high frequency to be mounted therein to exhibit the function. As an example of the element, an electronic component such as a semiconductor element is mounted. The electronic device **10** is the package **1** with an electronic component such as a semiconductor element mounted therein as an example of the element.

(11) The package **1** includes a substrate **2** and a frame **11**. The frame **11** includes a first frame **3**, a second frame **4**, and a third frame **7**. The first frame **3** is on the upper surface **24** of the substrate **2**. The second frame **4** is joined to the first frame **3**. The third frame **7** is on the upper surface of the first frame **3** and the upper surface of the second frame **4**. The second frame **4** has a through hole O in a side wall. The through hole O penetrates the side wall outward from an mounting area **21** in a plan view.

(12) The substrate **2** has, for example, a rectangular shape in a plan view. As illustrated in FIG. **4**, the upper surface **24** of the substrate **2** includes a mounting area **21** on which the electronic component **5** is to be mounted and a peripheral area **22** surrounding the mounting area **21**. The substrate **2** may be made of, for example, a metal material such as copper, iron, tungsten, molybdenum, nickel or cobalt, or an alloy containing any of these metal materials. The substrate **2** may have a function of efficiently dissipating the heat generated in the package **1** by the electronic component **5** to the outside of the package **1**. The substrate **2** may have good thermal conductivity. The thermal conductivity of the substrate **2** can be, for example, 15 W/(m.Math.K) or more and 450 W/(m.Math.K) or less. The coefficient of thermal expansion of the substrate **2** may be, for example, 3×10.sup.−6/K or more and 28×10.sup.−6/K or less.

(13) The substrate **2** is manufactured into a predetermined shape by applying metal working such as rolling or punching to an ingot that is obtained by casting a molten metal material into a mold and solidifying it. The length of each side of the substrate **2** in a plan view is, for example, 5 mm or more and 50 mm or less. More specifically, as illustrated in FIG. **4**, the substrate **2** may have a rectangular shape with a first long side **2**L**1**, a second long side **2**L**2**, a first short side **2**S**1**, and a second short side **2**S**2** in a plan view. In this case, the first long side **2**L**1** and the second long side **2**L**2** may be, for example, 10 mm or more and 50 mm or less, and the first short side **2**S**1** and the second short side **2**S**2** may be, for example, 5 mm or more and 20 mm or less. The thickness of the substrate **2** in the vertical direction (direction orthogonal to the upper surface **24** of the substrate **2**) is, for example, 0.3 mm or more and 5 mm or less.

(14) In order to prevent oxidative corrosion, a metal layer of nickel, gold or the like may be formed on the surface of the substrate **2** by electroplating or electroless plating. The thickness of the metal layer is, for example, 0.5 μm or more and 9 μm or less.

(15) The frame **11** is on the upper surface **24** of the substrate **2** to surround the mounting area **21**. As described above, the frame **11** includes the first frame **3**, the second frame **4**, and the third frame **7**. The first frame **3** is on the upper surface of the substrate **2** along the peripheral area **22** of the substrate **2**. The first frame **3** may serve as an input/output terminal and can exchange signals between the internal electronic component **5** and the outside. The first frame **3** has, for example, a U shape in a plan view and may surround the inside from three directions. That is, the first frame **3** may be any member that is on the upper surface **24** of the substrate **2** to surround at least a part of the mounting area **21**.

(16) As illustrated in FIGS. **3** and **4**, the first frame **3** may include a frame-shaped flat plate portion **31** and a frame-shaped wall portion **32** disposed on the flat plate portion **31**. As illustrated in FIGS. **2** and **3**, the flat plate portion **31** may have a protruding portion **31***a* protruding outward from the outer edge of the substrate **2** in a plan view. In this regard, a signal wiring **33** may be disposed on the upper surface of the protruding portion **31***a*. This allows the package **1** to be readily connected to an external electric circuit board via the protruding portion **31***a*. The external electric circuit

board may be, for example, a flexible board.
(17) In the present embodiment, as illustrated in FIG. **4**, the frame-shaped flat plate portion **31** of the first frame **3** includes a plate-shaped part in contact with the substrate **2** and a U-shaped frame part on the plate-shaped part. Even in this shape, the first frame **3** is disposed to surround at least a part of the mounting area **21** of the substrate **2**.
(18) The first frame **3** may include a metallized layer (not shown) that is on the under surface of the flat plate portion **31** and joined to the substrate **2**, the signal wiring **33** on the upper surface of the flat plate portion **31**, a metal layer (not shown) on the upper surface of the wall portion **32**, and a ground layer **34** on the upper surfaces of the flat plate portion **31** and the wall portion **32**. The signal wiring **33** is provided for electric conduction between the inside and outside of the package **1**. Further, the signal wiring **33** is a base for connecting a lead terminal or the like provided on the outside of the package **1**. The metal layer is a base for joining the second frame **4**, which will be described later, by a metal joining material such as a brazing material or solder. The flat plate portion **31** has a rectangular shape in a plan view. The wall portion **32** has a shape that is obtained by removing one side from a frame in a plan view. The flat plate portion **31** and the wall portion **32** may be integrally formed in one piece. Alternatively, an insulating layer for further wiring a signal line may be provided between the flat plate portion **31** and the wall portion **32**. The first frame **3** can be freely and suitably configured according to the design of the signal wiring and the like of the package **1**. The first frame **3** contains a ceramic material. That is, the flat plate portion **31** and the wall portion are made of an insulating material, for example a ceramic material such as an alumina-based sintered body, a mullite-based sintered body, a silicon carbide-based sintered body, an aluminum nitride-based sintered body, and a silicon nitride-based sintered body, or glass ceramics. The signal wiring **33** and the metal layer may be constituted by a base of a high-melting-point metal material such as tungsten, molybdenum or manganese and a plating layer of nickel, gold or the like formed thereon. The coefficient of thermal expansion of the flat plate portion **31** or the wall portion **32** containing a ceramic material is, for example, 3×10.sup.−6/K or more and 8×10.sup.−6/K or less.
(19) A method of manufacturing the first frame **3** will be described. On the upper surface, the under surface and the end surface opposed to the through hole O of the unsintered flat plate portion **31** before being fired, a plurality of signal wirings **33** and the ground layer **34** are formed along a side of the upper surface of the flat plate portion **31**, for example, by screen printing. Further, on the upper surface of the wall portion **32** before being fired, the metal layer and the ground layer **34** are formed by screen printing. Then, the wall portion **32**, on which the unsintered metal layer and ground layer **34** before being fired are formed, is pressure-bonded onto on the flat plate portion **31**, on which the unsintered signal wirings **33** and ground layer **34** before being fired are formed, and the wall portion **32** and the flat plate portion **31** are fired simultaneously. The first frame **3** can be manufactured in this way.
(20) In the fired first frame **3** after firing, the flat plate portion **31** and the wall portion **32** are integrated in one piece. In a plan view of the first frame **3**, each signal wiring **33** appears to be divided into two parts by the wall portion **32**, but the signal wiring **33** is continuous directly under the wall portion **32**. Accordingly, in a plan view of the first frame **3**, the part of each signal wiring **33** located inside the package **1** is electrically continuous with the part of the signal wiring **33** located outside the package **1**. This allows the electronic component **5** in the package **1** to be connected to an electric circuit board outside the package **1** via the signal wirings **33**.
(21) In a plan view, the length of each side of the flat plate portion **31** is, for example, 3 mm or more and 50 mm or less. The height of the flat plate portion **31** is, for example, 1 mm or more and 10 mm or less. Further, in a plan view, the length of each side of the wall portion **32** is, for example, 1 mm or more and 50 mm or less. The height of the wall portion **32** is, for example, 1 mm or more and 10 mm or less.
(22) Lead terminals (not shown) may be electrically connected on the signal wirings **33** via a

brazing material. The lead terminals are provided for electric connection to an external electric circuit board or the like. By disposing the adjacent signal wirings **33** with a gap between them, the adjacent signal wirings **33** are electrically insulated from each other, and the electromagnetic coupling is also reduced.

(23) The second frame **4** is joined to the upper surface **24** of the substrate **2** along the peripheral area **22** of the substrate **2** and is provided for protecting the electronic component **5** from the outside as with the first frame **3**. The second frame **4** may have a frame shape, for example, formed in a U-shape in a plan view. The second frame **4** may have a shape that surrounds the inside from three directions. That is, the second frame **4** may be any member that is on the upper surface **24** of the substrate **2** to surround at least a part of the mounting area **21**. Further, the second frame **4** may have the through hole O. For example, the second frame **4** is brazed to the upper surface **24** of the substrate **2** via a brazing material. This shape facilitates the processing of the second frame **4**, for example, compared to a second frame **4** that has a shape of surrounding all four sides and has an opening on a wall. As a result, the productivity can be improved. Further, also with regard to joining to the first frame **3**, this shape can reduce the joining area, which can reduce mutual influence due to thermal deformation.

(24) Further, the second frame **4** contains a metal material. More specifically, the second frame **4** is made of, for example, a metal material such as copper, iron, tungsten, molybdenum, nickel or cobalt, or an alloy containing any of these metal materials. The second frame **4** may have a function of efficiently dissipating the heat generated in the package by the electronic component **5** **1** to the outside of the package **1**. The thermal conductivity of the second frame **4** is, for example, 15 W/(m.Math.K) or more and 450 W/(m.Math.K) or less. The coefficient of thermal expansion of the second frame **4** is, for example, 3×10.sup.−6/K or more and 28×10.sup.−6/K or less.

(25) Further, as illustrated in FIG. **2**, the second frame **4** may have a size that fits in the substrate **2** in a plan view. The length of the side of the second frame **4** along the short sides of the substrate **2** is, for example, 5 mm or more and 20 mm or less. The height of the second frame **4** is, for example, 5 mm or more and 20 mm or less. In a plan view of the second frame **4**, the thickness of the second frame **4** is, for example, 0.5 mm or more and 3 mm or less. As used herein, the height of the second frame **4** refers to the size of the second frame **4** in the direction perpendicular to the substrate **2** in FIG. **3**. As will be described later, the thickness of the second frame **4** refers to the size of the second frame **4** in the direction perpendicular to the long sides or the short sides of the substrate **2** in a plan view as illustrated in FIG. **2**. The height and thickness of other frames can be defined in the same way.

(26) Further, a lens or the like that transmits an optical signal may be provided to the second frame **4** at a position where the through hole O is formed. For example, this allows an optical signal transmitted from the optical component mounted in the package **1** to be output to the outside.

(27) As illustrated in FIGS. **1** and **2**, the third frame **7** has a ring shape. The third frame **7** is on the upper surface of the first frame **3** and the upper surface of the second frame **4**. Since the first frame **3** and the second frame **4** are located along the upper surface **24** of the substrate **2**, the outer edge of the third frame **7** may have the same shape as that of the substrate **2**. Further, the third frame **7** contains a metal material. For example, the third frame **7** may be made of the same material as the second frame **4**. In this case, the second frame and the third frame has the same coefficient of thermal expansion, which can reduce the risk of breakage due to thermal expansion at the joint surface between the second frame **4** and the third frame **7**. The third frame **7** is made of, for example, a metal material such as copper, iron, tungsten, molybdenum, nickel or cobalt, or an alloy containing any of these metal materials.

(28) As illustrated in FIGS. **2** and **4**, the first frame **3** includes a first end **3***a* and a second end **3***b*, and the second frame **4** includes a third end **4***a* and a fourth end **4***b*. The first frame **3** and the second frame **4** are joined with each other via a joining material at the respective ends opposed to each other. More specifically, the first end **3***a* of the first frame **3** and the fourth end **4***b* of the

second frame **4** are joined to each other via the joining material, and the second end **3***b* of the first frame **3** and the third end **4***a* of the second frame **4** are joined to each other via the joining material. That is, the package **1** has such a shape that surrounds the mounting area **21** from all four sides by the first frame **3** and the second frame **4**. The joining material is a brazing material or the like. Then, the third frame **7**, which is another member, is disposed on the upper surface of the first frame **3** and the upper surface of the second frame **4** so as to surround the mounting area **21**.

(29) In the present embodiment having the above-described configuration, the first frame **3** and the second frame **4** are joined only at the respective ends in contrast to a configuration in which, for example, a second frame **4** has cutouts to which the ends and the upper surfaces of a first frame **3** are joined. This can reduce the joining area between the first frame **3** and the second frame **4**. With the reduced joining area, it is possible to reduce the stress due to the difference in coefficient of thermal expansion and to reduce a load such as thermal stress that has an influence on both sides. Further, the first frame **3** and the second frame **4** may have a stepped shape.

(30) In the present embodiment, the presence of the third frame **7**, which is a different member from the first frame **3** and the second frame **4**, ensures the joining strength to the lid **6**. Accordingly, even when the first frame **3** and the second frame **4** have different heights, it is possible to reduce the risk of the airtightness of the electronic device **10** being impaired.

(31) At the opposite ends where the first frame **3** and the second frame **4** are joined to each other, the first frame **3** may be thicker than the second frame **4**. That is, in a plan view as illustrated in FIG. **2**, the thickness w**1** at the first end **3***a* of the first frame **3** may be greater than the thickness w**4** at the fourth end **4***b* of the second frame **4**, and the thickness w**2** at the second end **3***b* of the first frame **3** may be greater than the thickness w**3** at the third end **4***a* of the second frame **4**. As used herein, a thickness w refers to the width of a frame member in a plan view. More specifically, at opposite ends, a thickness w refers to the size of a frame member in a direction perpendicular to the long sides of the substrate **2** in a plan view. With this configuration, the package **1** can maintain the joining strength and the airtightness even when a misalignment between the joining surfaces of the first frame **3** and the second frame **4** occurs due to a positional error at the time of joining. As a result, the productivity of the package **1** with high airtightness is improved.

(32) In the present embodiment, as illustrated in FIG. **2**, the thickness of the first frame **3** and the thickness of the second frame are both constant over the entire length. That is, the thickness w**1** of the first end **3***a* and the thickness w**2** of the second end **3***b* are equal, and the thickness w**3** of the third end **4***a* and the thickness w**4** of the fourth end **4***b* are equal. This configuration facilitates manufacture of the frame members. However the shape of each frame member is not limited to this, and any frame member may have a shape in which a certain part has a different thickness from the other part.

(33) When the substrate **2** has a rectangular shape, the position of the joint portion **8** between the first frame **3** and the second frame **4** may overlap the position of the long sides of the substrate **2**. That is, in a plan view as illustrated in FIG. **2** and FIG. **4**, the substrate **2** has a rectangular shape with the first long side **2**L**1**, the second long side **2**L**2**, the first short side **2**S**1** and the second short side **2**S**2**. In the plan view, a first joint portion **81**, at which the first end **3***a* of the first frame **3** and the fourth end **4***b* of the second frame **4** are joined to each other, may overlap the first long side **2**L**1** of the substrate **2**. Further, a second joint portion **82**, at which the second end **3***b* of the first frame **3** and the third end **4***a* of the second frame **4** are joined to each other, may overlap the second long side **2**L**2** of the substrate **2**. With this configuration, it is possible to fix the long sides of the substrate **2**, which tends to be deformed due to thermal stress, by the joining material or the like. This can reduce deformation of the substrate **2** due to thermal stress or the like. In this regard, the joint portion **8** is only preferred to be located substantially along the long sides of the substrate **2** and may be apart from the long sides within the range of production error or the like.

(34) As illustrated in FIG. **4**, the first joint portion **81** and the second joint portion **82** may be opposed to each other in a plan view. In this configuration, the first joint portion **81** and the second

joint portion **82** are arranged at the same position on the respective long sides of the substrate **2**. This can reduce the inclination and dimensional error of the package **1** caused by joining and improve the airtightness.

(35) In a plan view, a part of the first frame **3** is on the first short side **2S1** of the substrate **2**, and a part of the second frame **4** is on the second short side **2S2** of the substrate **2**. In this regard, the first joint portion **81** and the second joint portion **82** may be located closer to the first short side **2S1** than to the second short side **2S2** (not shown). This configuration increases the ratio of metal material in the package **1**. This can increase the thermal conductivity of the entire package **1** and improve the heat dissipation property. In addition, the cost for the package **1** can be reduced.

(36) As illustrated in FIGS. **1** and **2**, the outer edge of the first frame **3** may be located outside the outer edge of the third frame **7** in a plan view. This configuration can reduce the risk of a crack being formed by a stress on an end (corner) of the joining surface at which the first frame **3** and the third frame **7** are joined to each other.

(37) As illustrated in FIG. **6**, the third frame **7** may have a curved surface **71** at the outer periphery at the portion joined to the first frame **3** and/or the second frame **4**. That is, the third frame **7** includes a third joint portion **83** (not shown) joined to the first frame **3** and a fourth joint portion **84** joined to the second frame **4**, and at least one of the third joint portion **83** and the fourth joint portion **84** may have a curved surface **71** at the outer periphery. In this regard, the curved surface **71** extends at least from the under surface of the third frame **3** to the lateral surface of the outer periphery. This can disperse the thermal stress that is concentrically generated at the corners of the third frame land reduce the risk of breakage of the third frame **7**. The curved surface **71** may be provided either over the entire outer periphery of the first frame **3** and/or the second frame **4** or only at a part of the outer periphery.

(38) In this regard, the curved surface **71** may be located inside the outer edge of the first frame **3** in a plan view (see FIG. **3**). This configuration has both the effect of relaxing the thermal stress at the corners of the third frame **7** and the effect of improving the joining strength by promoting the brazing material to form a fillet at the time of joining to the first frame **3**. As a result, the airtightness can be further improved.

(39) Next, the electronic device **10** will be described referring to FIGS. **1** and **5**.

(40) As illustrated in FIG. **1**, the electronic device **10** can be manufactured by mounting the electronic component **5** in the package **1**. The electronic component **5** is electrically connected to the signal wirings **33** extended to the area surrounded by the second frame **4**. Further, for example, by fixing an optical fiber to the lens provided at the through hole O of the package **1**, it is possible to input/output an optical signal from the optical fiber into the package **1**.

(41) The lid **6** has, for example, the same size as the second frame **4** in a plan view. The lid **6** is joined to the third frame **7** disposed on the upper surface of the second frame **4** and the upper surface of the first frame **3** by seam welding or via an adhesive such as solder. The lid **6** is made of a metal material such as copper, iron, tungsten, molybdenum, nickel or cobalt. The thickness of the lid **6** is, for example, from 0.5 to 3 mm. By joining the lid **6** to the upper surface of the third frame **7**, the inner space surrounded by the package **1** and the lid **6** can be hermetically sealed.

(42) <Method of Manufacturing Electronic Device>

(43) Hereinafter, a method of manufacturing the electronic device **10** illustrated in FIG. **5** will be described. First, the substrate **2**, the first frame **3**, and the second frame **4** are prepared. Each of the substrate **2** and the second frame **4** is manufactured into a predetermined shape by applying metal working to an ingot that is obtained by casting a molten metal material into a mold and solidifying it.

(44) As for the first frame **3**, a ceramic green sheet to be the flat plate portion **31** and a ceramic green sheet die-cut corresponding to the wall portion **32** are prepared. Then, organic solvent containing molybdenum or manganese is applied to the ceramic green sheet to be the flat plate portion **31**, for example, by screen printing so that the signal wirings **33** of metal paste are formed.

Further, organic solvent containing molybdenum or manganese is applied to the ceramic green sheet to be the wall portion **32**, for example, by screen printing so that the metal layer of metal paste is formed. Then, the ceramic green sheet to be the wall portion **32** is laminated on the ceramic green sheet to be the flat plate portion **31**, and the laminate is sintered and cut into individual pieces having a desired shape. The first frame **3** is thus formed. Furthermore, the metal layer is formed on the end surfaces (first end **3***a* and second end **3***b*) of the first frame **3** by screen printing, which become the joint surfaces with the second frame **4**. The first frame **3** can be manufactured in this way. Regarding the prepared second frame **4**, a lens may be inserted in the through hole O of the second frame **4** and fixed by a brazing material.

(45) Then, the substrate **2**, the first frame **3**, and the second frame **4** thus prepared are joined together via a brazing material. In this step, pieces of the brazing material are placed respectively to portions of the second frame **4** to be joined to the substrate **2** and the first frame **3** beforehand. The second frame **4**, the substrate **2** and the first frame **3** are heated so that the brazing material spreads and wets the joint surfaces. Then, by cooling, the second frame **4**, the substrate **2** and the first frame are joined together. The electronic component accommodation package **1** can be manufactured in this way. Further, the electronic device **10** can be manufactured by mounting the electronic component or the like on the mounting area **21** of the manufactured electronic component accommodation package **1** with a joining material such as solder and covering the electronic component accommodation package **1** by the lid **6**.

(46) The present invention is not limited to the above-described embodiment, and various modifications and improvements including those of numerical values can be made without departing from the features of the present invention. Further, the method of mounting the electronic component is not specified in the present embodiment.

REFERENCE SIGNS LIST

(47) **1** Electronic component accommodation package **2** Substrate **21** Mounting area **22** Peripheral area **3** First frame **3***a* First end **3***b* Second end **31** Flat plate portion **31***a* (Protruding portion) **32** wall portion **33** Signal wiring **34** Ground layer **4** Second frame **4***a* Third end **4***b* Fourth end **5** Electronic component **6** Lid **7** Third frame **71** Curved surface **8** Joint portion **81** First joint portion **82** Second joint portion **10** Electronic device **11** Frame O Through hole w**1** to w**4** Thickness

Claims

1. An electronic component accommodation package, comprising: a substrate that has an upper surface including a mounting area on which an electronic component is to be mounted; and a frame that is on the upper surface to surround the mounting area and that has a through hole penetrating the frame outward from the mounting area in a plan view; wherein the frame includes: a first frame that is on the upper surface to surround at least a part of the mounting area and that contains a ceramic material; and a second frame that is on the upper surface to surround at least a part of the mounting area, that has the through hole and that contains a metal material, wherein the first frame includes a first end and a second end separated from the first end, and the second frame includes a third end and a fourth end separated from the third end, wherein the first end and the fourth end are joined to each other, and the second end and the third end are joined to each other, such that the first frame and the second frame are directly connected to each other on only a single plane that is perpendicular to the upper surface, wherein in the plan view, the first frame includes a first portion extending in a first direction and the second frame includes a second portion extending in the first direction, wherein the first portion includes the first end and the second portion includes the fourth end, and wherein in a perpendicular direction that is perpendicular to the first direction, an outer edge of the first end of the first frame is outside an outer edge of the fourth end of the second frame.

2. The electronic component accommodation package according to claim 1, further comprising a

third frame that is on an upper surface of the first frame and an upper surface of the second frame to surround the mounting area in the plan view and that contains a metal material, and wherein a material of the second frame is same as a material of the third frame.

3. The electronic component accommodation package according to claim 2, wherein in the plan view, an outer edge of the first frame is located outside an outer edge of the third frame.

4. The electronic component accommodation package according to claim 2, wherein the third frame includes a third joint portion joined to the upper surface of the first frame, and a fourth joint portion joined to the upper surface of the second frame, and wherein at least one of the third joint portion and the fourth joint portion has a curved surface at an outer periphery.

5. The electronic component accommodation package according to claim 4, wherein the third joint portion has the curved surface at the outer periphery, and wherein in the plan view, the curved surface is located inside an outer edge of the first frame.

6. An electronic device, comprising: the electronic component accommodation package according to claim 2; an electronic component mounted on the mounting area; and a lid that covers the electronic component and that is bonded on an upper surface of the third frame via an adhesive.

7. The electronic device according to claim 6, wherein a part of the first frame is located between the electronic component and the substrate.

8. The electronic component accommodation package according to claim 1, wherein in the plan view, the second frame has a U-shape along a part of an outer edge of the substrate.

9. The electronic component accommodation package according to claim 1, wherein in the plan view, a thickness of the first end of the first frame is greater than a thickness of the fourth end of the second frame, and a thickness of the second end of the first frame is greater than a thickness of the third end of the second frame.

10. The electronic component accommodation package according to claim 1, wherein in the plan view, the substrate has a rectangular shape with a first long side, a second long side, a first short side, and a second short side, and wherein in the plan view, a first joint portion overlaps the first long side of the substrate, and a second joint portion overlaps the second long side of the substrate, the first joint portion being a portion at which the first end of the first frame and the fourth end of the second frame being joined to each other, the second joint portion being a portion at which the second end of the first frame and the third end of the second frame being joined to each other.

11. The electronic component accommodation package according to claim 10, wherein in the plan view, the first joint portion and the second joint portion are opposed to each other.

12. The electronic component accommodation package according to claim 10, wherein in the plan view, a part of the first frame is on the first short side of the substrate, and a part of the second frame is on the second short side of the substrate, and wherein in the plan view, the first joint portion and the second joint portion are closer to the first short side than to the second short side.

13. The electronic component accommodation package according to claim 1, wherein the first frame includes a protruding portion that protrudes outward from an outer edge of the substrate in the plan view, and wherein a signal wiring is provided on an upper surface of the protruding portion.

14. The electronic component accommodation package according to claim 13, wherein the protruding portion comprises a first layer and a second layer on the first layer, and wherein in a side view, a first distance between an outer edge of the first layer and the outer edge of the substrate is different from a second distance between an outer edge of the second layer and the outer edge of the substrate.

15. The electronic component accommodation package according to claim 1, wherein in the plan view, a thickness of the first end of the first frame is greater than a thickness of the fourth end of the second frame, or wherein in the plan view, a thickness of the second end of the first frame is greater than a thickness of the third end of the second frame.

16. The electronic component accommodation package according to claim 1, wherein in the plan

view and in the perpendicular direction, an inner edge of the first end of the first frame is inside an inner edge of the fourth end of the second frame.

17. The electronic component accommodation package according to claim 1, wherein in the plan view, the first frame has a U-shape along a part of an outer edge of the substrate.

18. The electronic component accommodation package according to claim 1, wherein the first frame comprises a flat plate portion and a wall portion located on the flat plate portion, and wherein the flat plate portion includes a plate-shaped part in contact with the substrate and a U-shaped frame part on the plate-shaped part.

19. The electronic component accommodation package according to claim 1, wherein the first frame comprises a flat plate portion and a wall portion located on the flat plate portion, wherein a signal wiring is located on un upper surface of the flat plate portion, and wherein in the plan view, the signal wiring comprises a first part located inside the wall portion and a second part located outside the wall portion and a third part under the wall portion, and the first part is electrically continuous with the second part via the third part.