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Inductor

Abstract

An inductor includes a coil, a core that encloses the coil, a pair of terminals conducted with the coil, and a conductor shield that covers a surface of the core. The conductor shield covers at least a part of an upper surface or a side surface of the core. The conductor shield is directly conducted with any one terminal of the pair of terminals. The conductor shield is indirectly conducted with the other terminal via the coil.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation of PCT Application No. PCT/JP2022/041685, filed on Nov. 9, 2022, which is expressly incorporated herein by reference in its entirety.

BACKGROUND

Technical Field

[0002] The present invention relates to an inductor.

Related Art

[0003] Some inductors include a shield for shielding a magnetic field generated by a current flowing through the inductor.

[0004] Regarding this type of technology, JP 2019-516246 W discloses an inductor including a core body (**115**) surrounding a coil (**310**), a terminal (a lead (**120**) in JP 2019-516246 W) electrically connected to the coil (**310**), and a conductor shield (a shielding device (**500**) in JP 2019-516246 W) that covers at least a part of an outer surface of the core body (**115**).

[0005] In JP 2019-516246 W, the conductor shield is electrically connected to a solder pad (**900**), the terminal is electrically connected to a solder pad (**910**) different from the solder pad (**900**) to which the conductor shield is connected, and the inductor is grounded.

[0006] When a current flows through a coil and a magnetic field is generated, an eddy current is generated in a conductor shield. In JP 2019-516246 W, the eddy current is caused to flow through a circuit via a solder pad (**900**). However, in a case of such a configuration, it is necessary to provide a dedicated circuit for causing the eddy current to flow around the inductor, and there is a problem that design of the circuit is restricted.

[0007] The present invention has been made in view of the above-described problems, and provides an inductor that does not impair a degree of freedom in designing a circuit.

SUMMARY

[0008] An inductor of the present invention is an inductor including a coil, a core that encloses the coil, a pair of terminals conducted with the coil, and a conductor shield that covers a surface of the core, in which the conductor shield covers at least a part of an upper surface or a side surface of the core, the conductor shield is directly conducted with any one terminal of the pair of terminals, and the conductor shield is indirectly conducted with the other terminal via the coil.

Effect of the Invention

[0009] According to an inductor of the present invention, since a conductor shield is conducted with a terminal and an eddy current is caused to flow in a circuit to which the terminal is connected, it is not necessary to separately provide a circuit for causing an eddy current to flow. As a result, a degree of freedom in designing an electronic circuit around the inductor can be maintained.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The above-described object and other objects, features, and advantages will become more apparent from the following preferred embodiments and accompanying drawings.

[0011] FIG. **1** is a perspective view illustrating an example of an inductor according to a first embodiment of the present invention. A brazing material is not illustrated.

[0012] FIG. **2** is a perspective view illustrating a coil and a terminal of the inductor according to the first embodiment.

[0013] FIGS. **3**A and **3**B are top views of the inductor according to the first embodiment. A brazing material is not illustrated in FIGS. **3**A and **3**B. A conductor shield is not illustrated in FIG. **3**B.

[0014] FIGS. **4**A and **4**B are front views of the inductor according to the first embodiment. A brazing material is not illustrated in FIG. **4**A.

[0015] FIG. **5**A is a back view of the inductor according to the first embodiment. FIG. **5**B is a right side view of the inductor according to the first embodiment.

[0016] FIG. **6**A is a longitudinal cross-sectional view of the inductor according to the first embodiment when a cross section taken along a one-dot chain line illustrated in FIG. **3**A is seen in a direction of arrow VI-VI. FIG. **6**B is an enlarged view of a portion X indicated by a dotted line in FIG. **6**A.

[0017] FIG. **7** is a front view of an inductor according to a second embodiment.

[0018] FIG. **8** is a longitudinal sectional view of an inductor according to a third embodiment.

[0019] FIG. **9** is a perspective view of an inductor according to a fourth embodiment.

[0020] FIG. **10** is a longitudinal cross-sectional view of the inductor according to the fourth embodiment when a cross section taken along a one-dot chain line illustrated in FIG. **9** is seen in a direction of arrow X-X.

[0021] FIG. **11**A is a top view of the inductor according to the fourth embodiment. FIG. **11**B is a back view of the inductor according to the fourth embodiment.

DETAILED DESCRIPTION

[0022] Various components of an inductor of the present invention do not need to be independent from each other, and it is allowed that a plurality of components is formed as one member, one component is formed of a plurality of members, a certain component is a part of another component, a part of a certain component overlap a part of another component and the like. Hereinafter, embodiments of the present invention will be described with reference to the drawings. Note that, in the respective drawings, corresponding components are denoted by the same reference numeral, and redundant description will not be repeated.

[0023] Note that, in the present embodiments, as illustrated in the drawing, front-rear, right-left, and up-down directions are defined and described. However, the directions are defined for convenience in order to simply describe a relative relationship of the components, and the direction when manufacturing or using a product on which the present invention is performed is not limited. Sometimes, a center side of the inductor is referred to as an inner side, the opposite side is referred to as an outer side, a direction from a surface of the inductor toward the center is referred to as an inward direction, and the opposite direction is referred to as an outward direction.

[0024] A plane referred to in the present invention means a shape physically formed so as to obtain a plane, and it goes without saying that this is not required to be a geometrically perfect plane.

First Embodiment

[0025] FIG. **1** is a perspective view illustrating an example of an inductor according to a first embodiment of the present invention.

[0026] First, an outline of the inductor according to the present embodiment will be described.

[0027] An inductor **100** includes a coil **20**, a core **30** that encloses the coil **20**, a pair of terminals **40** conducted with the coil **20**, and a conductor shield **10** that covers a surface of the core **30**. The conductor shield **10** covers at least a part of an upper surface or a side surface of the core **30**. The conductor shield **10** is directly conducted with any one terminal (a front terminal **41**) of the pair of terminals **40**. The conductor shield **10** is indirectly conducted with the other terminal (a rear terminal **42**) via the coil **20**.

[0028] Next, the inductor **100** according to the present embodiment will be described in detail.

[0029] As illustrated in FIG. **2**, the coil **20** is obtained by winding a wire material (a coil wire and the like) made of a conductive material such as metal. A portion of the coil **20** in which the wire material is wound is sometimes particularly referred to as a winding portion **21**. In FIG. **2**, each turn of the wound wire material is not illustrated. The wire material may have a circular cross section or a flat cross section (for example, an ellipse or a horizontally long rectangle). In the present embodiment, a winding axis direction of the coil **20** is the up-down direction, but there is no limitation. The winding axis direction of the coil **20** may be a right-left direction, a front-rear

direction and the like.
[0030] As illustrated in FIG. **1**, the coil **20** is enclosed in the core **30**. Here, enclosure is intended to mean arrangement of a substantially entire coil **20** in an envelope volume of the core **30**. It is also possible that a part of the coil **20** is not covered with the core **30** and is visible from outside. For example, a lead-out portion **22** (a portion led out from the winding portion **21**), which is one end of the wire material of the coil **20**, may be arranged outside the core **30**. Preferably, an entire winding portion **21** of the coil **20** or an entire coil **20** including the winding portion **21** and the lead-out portion **22** (both ends of the coil wire and the like) is covered with the core **30**.
[0031] The core **30** is a magnetic member surrounding the coil **20**. Examples of a magnetic material forming the core **30** include ferrite and the like, for example. In the present embodiment, the core **30** also enters inside the coil **20** in a radial direction, and forms a closed loop as a whole. More specifically, the core **30** of the present embodiment is integrally formed by placing the coil **20** and the terminals **40** in a mold and pouring a resin containing the magnetic material such as ferrite into the mold. That is, the inductor **100** in the present embodiment is a molded coil.
[0032] In place of the present embodiment, as will be described later in a modification, the core **30** may be divided into a plurality of parts.
[0033] The core **30** of the present embodiment has a substantially rectangular parallelepiped shape as a whole. As illustrated in FIG. **4**A or **6**A, the core **30** includes an upper surface **30***c* facing upward, a lower surface **30***d* facing downward, a front surface **30***e* facing forward, a back surface **30***f* facing rearward, a left surface **30***g* facing leftward, and a right surface **30***h* facing rightward. In the core **30**, areas of the upper surface **30***c* and the lower surface **30***d* are larger than areas of the front surface **30***e*, the back surface **30***f*, the left surface **30***g*, and the right surface **30***h*, and the core **30** has a flat shape as a whole.
[0034] The shape of the core **30** is not limited to a rectangular parallelepiped, and may be, for example, a cylinder or a prism including a polygonal bottom surface. The surface forming the core **30** does not need to be a perfect plane, and may be curved or distorted.
[0035] In the present embodiment, as illustrated in FIGS. **3**B and **6**A, the front surface **30***e* and the back surface **30***f* of the core **30** are formed into a one-step stepwise shape. That is, for example, the front surface **30***e* (refer to FIG. **6**A) includes a recessed surface **30***e***2** formed inside in the front-rear direction, a stair surface **30***e***1** facing upward, and a projected surface **30***e***3** formed outside in the front-rear direction as illustrated in FIG. **6**B. The back surface **30***f* similarly includes a recessed surface, a stair surface, and a projected surface.
[0036] In place of the present embodiment, the front surface **30***e* and the back surface **30***f* may be formed without a step. As illustrated in FIG. **6**B, in the present embodiment, the recessed surface **30***e***2** is slightly inclined outward in the front-rear direction as it is closer to a lower side, and the projected surface **30***e***3** is slightly inclined inward in the front-rear direction as it is closer to a lower side.
[0037] The inductor **100** includes a pair of terminals **40** including the front terminal **41** and the rear terminal **42**. Here, the fact that the inductor **100** includes a pair of terminals **40** means that this includes at least the pair of terminals **40** connected to both ends of the coil wire. The inductor **100** may include a terminal other than the pair of terminals. The front terminal **41** and the rear terminal **42** are conducted with one end and the other end of the coil **20**, respectively. In other words, in this embodiment, the pair of terminals **40** are input/output terminals or a member composing the input/output terminal (such as a terminal where a coil wire is connected to and twisted around the input/output terminal). Either the front terminal **41** or the rear terminal **42** may be an input terminal, and either may be an output terminal. In other words, each of the pair of terminals **40** in this embodiment is a terminal that constitutes the main circuit in the circuit that the inductor **100** will constitute when it is mounted on the mounting substrate. In this embodiment, each of the pair of terminals **40** is not another terminal such as a ground terminal (earth terminal).
[0038] Specifically, as illustrated in FIG. **2**, an end (a connecting branch **46***a* to be described later)

of the terminal **40** inserted into the core **30** is bent into a U shape, and grips one end or the other end of the coil **20** to sandwich one end of the coil **20** in the up-down direction. One end of the coil **20** and the terminal **40** are joined to each other by a method such as laser welding, resistance welding and the like, for example. An aspect of conduction between the coil **20** and the terminal **40** is not limited to such direct contact. The coil **20** may be conducted with the terminal **40** via a different member. For example, one end of the wire material forming the coil may be bound to a binding terminal of a member different from the terminal **40**, and the binding terminal and the terminal **40** may be connected to each other to electrically connect the coil **20** and the terminal **40** via the binding terminal. The coil **20** and the terminal **40** may be integrally formed of the same member.

[0039] As illustrated in FIG. **2**, the terminal **40** includes a mounting portion **43** joined to a mounting substrate (not illustrated), an externally arranged portion **44** extending to the side surface of the core **30** (the front surface **30***e* or the back surface **30***f* in the present embodiment), and an insertion portion **45** inserted into the core **30**. In the present embodiment, an upper end of the terminal **40** is the insertion portion **45**, a lower end is the mounting portion **43**, and a part between the insertion portion **45** and the mounting portion **43** is the externally arranged portion **44**.

[0040] The insertion portion **45** corresponding to the upper end of the terminal **40** is inserted into the core **30**. As illustrated in FIG. **6**B, a terminal upper surface **45***a* of the insertion portion **45** is flush with the step surface **30***e***1** on the front surface **30***e* of the core **30**.

[0041] As illustrated in FIG. **6**A, the terminal **40** projects forward or rearward from the side surface (the front surface **30***e* or the back surface **30***f*) of the core **30**. That is, in the present embodiment, the front-rear direction is a projecting direction of the terminal **40**. As illustrated in FIGS. **1** and **2**, a portion of the terminal **40** projecting outward from the core **30** is bent with respect to the insertion portion **45**, and a part (the externally arranged portion **44**) projecting from the core **30** is arranged along the front surface **30***e* or the back surface **30***f* of the core **30**.

[0042] The terminal **40** is bent between the mounting portion **43** and the externally arranged portion **44**. The mounting portion **43**, which is the lower end of the terminal **40**, is substantially parallel to the lower surface **30***d* of the core **30**. As illustrated in FIG. **6**A, a part of the mounting portion **43** is arranged inside a terminal arrangement portion **30***i* formed to be recessed upward on the lower surface **30***d* of the core **30**. A lower surface of the mounting portion **43** is arranged below the lower surface **30***d* of the core **30** so that the mounting portion **43** projects from the lower surface **30***d* of the core **30**.

[0043] As illustrated in FIG. **2**, the upper end of the terminal **40** is branched as described later to form two or more branches **46** (the connecting branch **46***a* and a non-contact branch **46***b* described later). As illustrated in FIGS. **4**A and **5**A, a projection **48** formed into an upwardly projecting shape is provided between the connecting branch **46***a* and the non-contact branch **46***b* at a proximal end of the branch **46**. The projection **48** projects along the side surface of the core **30** without being bent like the branch **46**. A recess **47** recessed downward is formed between the projection **48** and the connecting branch **46***a* and between the projection **48** and the non-contact branch **46***b*.

[0044] As illustrated in FIG. **4**A or **5**A, the externally arranged portion **44** has a wider portion on an upper side and a narrower portion narrower than the wider portion on a lower side, so that this has a T shape as a whole. Among the wider portion, a part connected to the non-contact branch **46***b* to be described later is C-chamfered to form a slope **44***b*, whereas a part connected to the connecting branch **46***a* is not C-chamfered and includes a corner.

[0045] A width of the externally arranged portion **44** (a width of a narrow portion of the externally arranged portion **44**) is preferably equal to or more than ⅓ or equal to or more than half of a lateral width of a second surface or a third surface of the core **30** described later. Since the width of the externally arranged portion **44** is large and the second surface or the third surface is widely covered with the externally arranged portion **44**, a leakage magnetic flux is blocked by the externally arranged portion **44**.

[0046] The inductor **100** is grounded to the mounting substrate such that the mounting portion **43** is in contact with the mounting substrate. The mounting portion **43** and the mounting substrate are joined by soldering or the like to be electrically connected to each other.
[0047] In the present embodiment, the terminal is a planar mounting terminal including a flat mounting portion, but there is no limitation. In the terminal **40**, the mounting portion **43** may be a pin-shaped terminal.
[0048] The conductor shield **10** is made of a conductive thin plate. Examples of the conductive material include metal such as copper. In the present embodiment, the conductor shield **10** covers a part of each of the upper surface **30***c*, the left surface **30***g*, the right surface **30***h*, the front surface **30***e*, and the back surface **30***f* of the core **30** as described later. It is possible that the conductor shield **10** covers only a part of the upper surface or only a part of the side surface. As will be described later in the modification, the conductor shield **10** may cover an entire surface of the core **30**.
[0049] More specifically, in the conductor shield **10**, a thin plate made of metal is bent as illustrated in FIG. **1**, and covers the upper surface and the side surface of the core **30**. The thin plate made of metal is formed into an X shape, and as illustrated in FIG. **3**A, a central portion (a cover portion **11** to be described later) of the X shape covers a substantially entire upper surface **30***c* of the core **30**. As illustrated in FIGS. **6**A and **6**B, a part of the conductor shield **10** extending forward from the upper surface **30***c* of the core **30** (a front lip **12** to be described later) is bent in the vicinity of a boundary between the upper surface **30***c* and the front surface **30***e* of the core **30**, and covers the front surface **30***e* of the core **30**. A length of the front lip **12** (dimension directed downward with respect to the upper surface **30***c* of the core **30**) is preferably equal to or more than a distance to the terminal upper surface **45***a* of the front terminal **41** with reference to the upper surface **30***c* of the core **30**. In other words, the length of the front lip **12** is preferably equal to or more than a distance to the stair surface **30***e***1** of the front surface **30***e* with reference to the upper surface **30***c* of the core **30**. In the present embodiment, the length of the front lip **12** is equal to the distance to the terminal upper surface **45***a* of the front terminal **41** with reference to the upper surface **30***c* of the core **30**, and is equal to the distance to the stair surface **30***e***1** with reference to the upper surface **30***c* of the core **30**.
[0050] As illustrated in FIG. **5**B, a portion (a rear lip **14**) of the conductor shield **10** extending rearward from the upper surface **30***c* of the core **30** and bent covers a part of the back surface **30***f* of the core **30**. A length of the rear lip **14** is preferably shorter than the distance to the terminal upper surface **45***a* of the front terminal **41** with reference to the upper surface **30***c* of the core **30**. As illustrated in FIGS. **4**A and **5**B, a part of the conductor shield **10** (a right lip **15** or a left lip **16**) extending rightward or leftward from the upper surface **30***c* and bent covers the right surface **30***h* or the left surface **30***g* of the core **30**. A length of the right lip **15** and the left lip **16** is preferably equal to or more than half, more preferably equal to or more than ⅔ of a thickness of the core **30**. FIG. **5**B illustrates a right side view of the inductor **100**, and a right surface of the inductor **100** is mirror-symmetrical with a left surface.
[0051] Since the conductor shield **10** covers the side surface (front surface **30***e*, back surface **30***f*, right surface **30***h*, or left surface **30***g*) in addition to the upper surface **30***c* of the core **30**, it is possible to shield the magnetic flux leaking from the side surface and to prevent misalignment of the conductor shield **10**.
[0052] In place of the present embodiment, the conductor shield **10** may include only the cover portion **11** that covers the upper surface **30***c* (a first surface to be described later) without including the lip (the front lip **12**, rear lip **14**, right lip **15**, and left lip **16**). It is possible that the conductor shield **10** does not cover all of the four surfaces, which are the side surfaces, and covers only a part of the side surfaces with the lip.
[0053] As illustrated in FIG. **3**A, a cutout **17** is provided between the front lip **12**, the rear lip **14**, the right lip **15**, and the left lip **16**, and these lips project from the cover portion **11** independently of

each other. By providing the cutout **17**, the conductor shield **10** can be flexibly deformed to cover the core **30**.

[0054] In place of the present embodiment, it is possible that the cutout **17** is not provided and portions of the conductor shield **10** covering the respective side surfaces may be continuously connected to each other.

[0055] Here, the fact that the conductor shield **10** and the front terminal **41** are directly conducted with each other means that the conductor shield **10** is conducted with the front terminal **41** without the coil **20**. In the present embodiment, as illustrated in FIG. **1**, the conductor shield **10** (the front lip **12**) and the terminal **40** are in contact with each other, and the conductor shield **10** is directly conducted with the terminal **40**, but there is no limitation. The conductor shield **10** can be conducted with the front terminal **41** via a member other than the coil **20**. For example, it is possible that the conductor shield **10** does not include the front lip **12**, and the cover portion **11** of the conductor shield **10** is conducted with the terminal **40** via a conductive wire.

[0056] The fact that the conductor shield **10** is indirectly conducted with the rear terminal **42** means that they are conducted with each other via the coil **20**. More specifically, the conductor shield **10** and the rear terminal **42** are conducted with each other via the front terminal **41** and the coil **20**. In a case where the conductor shield **10** and the rear terminal **42** are conducted with each other via a path without the coil **20**, the front terminal **41** and the rear terminal **42** are conducted with each other via two paths of a path including the conductor shield **10** and a path including the coil **20**, and the circuit is short-circuited. In contrast, in the present embodiment, as illustrated in FIG. **5**A, the conductor shield **10** and the rear terminal **42** are not in contact with each other, so that a short-circuit does not occur.

[0057] When a current flows through the inductor **100**, the magnetic flux tends to leak out of the core **30**. When this leakage magnetic flux is blocked by the conductor shield **10**, an eddy current is generated in the conductor shield **10**. A line of magnetic force generated by the eddy currents cancels the leakage magnetic flux and suppress an influence on components and the like on the substrate. Since the conductor shield **10** is conducted with the front terminal **41**, the generated eddy current can flow to an electric circuit including the front terminal **41**, the coil **20**, and the rear terminal **42**. In other words, the eddy current flows through the main circuit, which is composed of the front terminal **41**, the rear terminal **42** and the coil **20**.

[0058] Therefore, it is not necessary to design an electric circuit including a solder pad (**910**) for causing the eddy current to flow in addition to a solder pad (**900**) for connecting the inductor **100** as in JP 2019-516246 W. In other words, it is not necessary to separately provide a circuit branching from the main circuit as a circuit for passing eddy currents (such as a ground circuit). For example, in the present embodiment, inductor **100** does not have any terminals (in particular, a ground terminal) other than the input/output terminals. That is, a degree of freedom in designing the circuit around the inductor **100** can be secured.

[0059] The core **30** includes the first surface to which an end face of the coil **20** (the winding portion **21**) faces. In other words, the first surface of the core **30** faces the end face of the coil **20** in the winding direction of the coil **20**. In the present embodiment, as illustrated in FIGS. **2** and **6**A, the end face of the coil **20** faces upward or downward, and the first surface is the upper surface **30***c* or the lower surface **30***d* of the core **30**. The first surface in the present embodiment is the upper surface **30***c* of the core **30**. In place of the present embodiment, in a case where the end face of the coil **20** faces forward and rearward or rightward and leftward, the first surface is the front surface **30***e* or the back surface **30***f*, or the left surface **30***g* or the right surface **30***h*.

[0060] The conductor shield **10** includes the cover portion **11** that covers at least a part of the first surface (the upper surface **30***c*). In the present embodiment, as illustrated in FIG. **3**A, the cover portion **11** covers the substantially entire upper surface **30***c*, but since the cutout **17** is provided on the cover portion **11**, each corner of the rectangular upper surface **30***c* is locally exposed from the cover portion **11** in plan view. In place of the present embodiment, the cover portion **11** may cover the entire upper surface **30***c*, and the cover portion **11** may cover a smaller shape and a part of a dimension of the upper surface **30***c*. It is preferable that the end face of the coil **20** and the cover portion **11** overlap with each other as seen in the winding axis direction of the coil (the up-down direction in the present embodiment). Furthermore, it is more preferable that the end face of the coil **20** is covered with the cover portion **11** as seen in the winding axis direction of the coil.

[0061] When the current flows through the inductor **100**, the line of magnetic force is emitted from the end face of the coil **20**, and become a main factor of the leakage magnetic flux from the inductor **100**. By covering the surface of the core **30** to which the end face of the coil **20** faces, with the conductor shield **10**, the line of magnetic force emitted from the end face of the coil **20** to leak out of the core **30** is blocked, and the magnetic flux is excellently prevented from leaking out of the inductor **100**.

[0062] The core **30** includes the second surface along which one terminal (the front terminal **41**) extends. In a case where the cover portion **11** covers the upper surface **30***c* of the core **30**, the second surface is a part of the side surface. Here, the surface of the core **30** along which the terminal **40** extends is more specifically a surface along which the externally arranged portion **44** of the terminal **40** extends. In the present embodiment, the externally arranged portion **44** of the front terminal **41** is arranged along the front surface **30***e* of the core **30**. The second surface in the present embodiment is the front surface **30***e* of the core **30**. The second surface may be another surface (the right surface **30***h*, left surface **30***g*, or back surface **30***f*) of the side surfaces.

[0063] A part (the front lip **12**) of the conductor shield **10** covers a part of the second surface (the front surface **30***e*). As illustrated in FIG. **4**A, the front lip **12** covers a substantially entire surface of the front surface **30***e* of the core **30** arranged above the terminal upper surface **45***a* (refer to FIG. **6**B) of the front terminal **41**. The front lip **12** may extend below the terminal upper surface **45***a* of the front terminal **41** to cover a lower side of the front surface **30***e* of the core **30**.

[0064] As illustrated in FIG. **6**A, the conductor shield **10** (the front lip **12**) that covers the second surface (the front surface **30***e*) and one terminal (the front terminal **41**) are in contact with each other. In the present embodiment, as illustrated in FIG. **6**B and described later, a surface on an upper side of the front terminal **41** (the terminal upper surface **45***a*) and the end face **12***b* of the front lip **12** are in surface contact with each other. As described in a third embodiment, the front terminal **41** and the front lip **12** may be substantially in line contact with each other. The front terminal **41** and the front lip **12** may be in point contact with each other.

[0065] Since the conductor shield **10** covers a part of the second surface (the front surface **30***e*), the magnetic flux leaking from the core **30** can be more excellently shielded.

[0066] As illustrated in FIGS. **6**A and **6**B, an inner surface (the lip inner surface **12***a*) of a part (the front lip **12**) of the conductor shield **10** that covers the second surface (the front surface **30***e*) of the core **30** is arranged inside an inner surface (a terminal inner surface **44***c*) along the second surface of one terminal (the front terminal **41**) in plan view. More strictly, the lip inner surface **12***a* is arranged inside the terminal inner surface **44***c* in the projecting direction (front-rear direction) of the terminal **40**. The terminal inner surface **44***c* along the front surface **30***e* of the front terminal **41** is an inner surface of the externally arranged portion **44** of the front terminal **41**.

[0067] The fact of being arranged inside in plan view means being arranged on the center side of the inductor **100** as seen from above. The plan view is not limited to direct visual recognition. For example, it is sufficient that the lip inner surface **12***a* is arranged inside in the front-rear direction with respect to the terminal inner surface **44***c* of the front terminal **41** as seen in a vertical cross section as illustrated in FIG. **6**B.

[0068] As illustrated in FIG. **6**B, the terminal **40** is bent between the insertion portion **45** and the externally arranged portion **44**, and the outer surface of the bent portion is a curved surface **44***d*. By arranging the lip inner surface **12***a* inside the terminal inner surface **44***c* of the front terminal **41** in the terminal projecting direction, at least a part of the end face **12***b* (including a side of the rectangular end face **12***b*) of the front lip **12** is in contact with the upper surface (the terminal upper surface **45***a*) of the insertion portion **45** of the front terminal **41** as illustrated in FIG. **6**B. In the present embodiment, a part on an inner side in the terminal projecting direction of the end face **12***b* of the front lip **12** is in contact with the horizontal terminal upper surface **45***a* of the insertion portion **45**, and another part on an outer side in the terminal projecting direction of the end face **12***b* faces the curved surface **44***d* so as to be separated therefrom. The entire end face **12***b* of the front lip **12** may be in contact with the terminal upper surface **45***a* of the insertion portion **45**. In this case, an outer surface of the front lip **12** is preferably arranged inside the terminal inner surface **44***c* of the front terminal **41** in the terminal projecting direction, or arranged flush with the terminal inner surface **44***c* of the front terminal **41**.

[0069] In this manner, since the lip inner surface **12***a* of the front lip **12** and the terminal inner surface **44***c* of the front terminal **41** are shifted from each other in the front-rear direction, and the front lip **12** and the front terminal **41** are in surface contact with each other on the end face **12***b*, the front terminal **41** and the conductor shield are excellently conducted with each other. A part of the end face **12***b* of the front lip **12** and the curved surface **44***d* of the front terminal **41** face each other, so that a cavity having a shape that is surrounded by the end face **12***b* of the front lip **12** and the curved surface **44***d* of the front terminal **41** and is tapered inward in the terminal projecting direction is formed. When solder **50** described later enters the cavity, the conductor shield **10** and the front terminal **41** are firmly connected to each other.

[0070] A distance between the lip inner surface **12***a* and the terminal inner surface **44***c* of the front terminal **41** (a distance Z**1** in FIG. **6**B) is preferably equal to or more than ¼ of the thickness (dimension in the front-rear direction) of the front lip **12**, or equal to or more than half of the thickness. In other words, the thickness of the front lip **12** is a front-rear width of the end face **12***b* of the front lip **12**. A maximum value of the distance Z**1** is preferably equivalent to or smaller than the thickness of the front lip **12**. Here, the distance between the lip inner surface **12***a* and the terminal inner surface **44***c* is a distance in the terminal projecting direction between a lower end of the lip inner surface **12***a* and an upper end of the terminal inner surface **44***c*.

[0071] In the present embodiment, as illustrated in FIG. **6**B, the lip inner surface **12***a* is arranged flush with an upper end of the projected surface **30***e***3** of the front surface **30***e* of the core **30**.

[0072] In place of the present embodiment, the conductor shield **10** may be in contact with a portion (such as the curved surface **44***d*) other than the terminal inner surface **44***c* of the front terminal **41**.

[0073] In place of the present embodiment, the lip inner surface **12***a* and the terminal inner surface **44***c* of the front terminal **41** may be arranged flush with each other, or the lip inner surface **12***a* of the front lip **12** may be arranged outside the terminal inner surface **44***c* of the front terminal **41**. In this case, since the conductor shield **10** and the front terminal **41** are substantially in line contact or not in contact with each other, it is preferable to sufficiently secure conduction between the conductor shield **10** and the front terminal **41** by brazing such as soldering.

[0074] As illustrated in FIG. **6**B, a part (a shield covering portion **30***a*) covered with the conductor shield **10** of the second surface (the front surface **30***e*) of the core **30** is formed inside a part (a terminal covering portion **30***b*) covered with one terminal of the second surface in plan view. The shield covering portion **30***a* is a region covered with the conductor shield **10** in the front surface **30***e* of the core **30**. In the present embodiment, a substantially entire portion above the stair surface **30***e***1** of the front surface **30***e* of the core **30** except for a part exposed from the cutout **17** is the shield covering portion **30***a*.

[0075] A distance between the shield covering portion **30***a* and the terminal covering portion **30***b* (Z**2** in FIG. **6**B) is preferably equivalent to the distance Z**1** between the terminal inner surface **44***c* of the front terminal **41** and the lip inner surface **12***a* or longer than the distance Z**1**. Here, equivalent means that the distance Z**2** is equal to or more than half and equal to or less than twice of the distance Z**1**. The distance between the shield covering portion **30***a* and the terminal covering portion **30***b* is a distance between a lower end of the shield covering portion **30***a* and an upper end of the terminal covering portion **30***b* in the terminal projecting direction.

[0076] In the present embodiment, as illustrated in FIGS. **6**A and **6**B, an entire portion above the stair surface **30***e***1** (the recessed surface **30***e***2**) in the front surface **30***e* of the core **30** is arranged inside an entire portion below the stair surface **30***e***1** (the projecting surface **30***e***3**) in the front surface **30***e* of the core **30** in the terminal projecting direction. In place of the present embodiment, an aspect may be adopted in which only the shield covering portion **30***a* of the front surface **30***e* is recessed rearward, and the recessed shield covering portion **30***a* is arranged inside the terminal covering portion **30***b* in the terminal projecting direction. Conversely, it is possible that only the terminal covering portion **30***b* of the front surface **30***e* of the core **30** projects forward, and the projected terminal covering portion **30***b* is arranged outside the shield covering portion **30***a* in the terminal projecting direction. On the front surface **30***e* of the core **30**, a portion not covered with the front lip **12** may be outside or inside the terminal covering portion **30***b* in the terminal projecting direction.

[0077] Since the shield covering portion **30***a* and the terminal covering portion **30***b* are misaligned on the second surface in this manner, the front lip **12** is easily arranged inside the front terminal **41** in plan view. In other words, the end face **12***b* of the front lip **12** easily comes into surface contact with the front terminal **41**, and the conduction between the conductor shield **10** and the front terminal **41** is easily kept excellently.

[0078] In the present embodiment, as illustrated in FIG. **6**A, an inner surface of the cover portion **11** (a cover inner surface **11***a*) is arranged substantially parallel to the upper surface **30***c* of the core **30**.

[0079] It is possible that an insulating material is arranged or not by application or the like on a part of the surface of the core **30** covered with the conductor shield **10** (a part of the upper surface and the side surface) or a substantially entire area of the inner surface of the conductor shield **10**. In a case where the insulating material is arranged between the core **30** and the conductor shield **10**, the cover inner surface **11***a* of the cover portion **11** and the upper surface **30***c* of the core **30** are arranged along with the insulating material interposed therebetween. In a case where the insulating material is not arranged, the surface center and a peripheral edge of the cover inner surface **11***a* of the cover portion **11** are in direct contact with the upper surface **30***c* of the core **30**.

[0080] In the inductor disclosed in JP 2019-516246 W, it is necessary to apply an insulating material to an inner surface of a conductor shield or a surface of a core (**115**) in order to shield the inductor from noise from the solder pad (**910**) to which the conductor shield is connected. In the present embodiment, since the noise does not flow into the conductor shield **10**, it is not necessary to apply the insulating material between the core **30** and the conductor shield **10**. Therefore, a step of applying the insulating material is omitted, and the inductor **100** can be manufactured easily at a low cost.

[0081] In the present embodiment, the conductor shield **10** and one terminal (the front terminal **41**) are joined to each other by welding or brazing. Examples of the welding include fusion welding with a laser or a gas. Examples of the brazing include soldering by solder or the like and brazing by other metal brazing. In the present embodiment, the conductor shield **10** and the front terminal **41** are brazed to each other by the solder **50**.

[0082] As described below, the conductor shield **10** may be brazed or welded to both the branches **46** of the front terminal **41** described below, or may be brazed or welded to only one branch. By joining the conductor shield **10** to the front terminal **41** by welding or brazing, the conductor shield **10** is prevented from being separated from the front terminal **41**, and the conduction between the conductor shield **10** and the front terminal **41** is secured.

[0083] In place of the present embodiment, it is possible that the conductor shield **10** and the front terminal **41** are not joined to each other by brazing or welding. For example, the conductor shield **10** is allowed to abut the front terminal **41** to secure the conduction. The conductor shield **10** and the front terminal **41** may be fixed with an adhesive.

[0084] As illustrated in FIG. **2**, one terminal (the front terminal **41**) includes two or more branches formed by branching of one end. In the present embodiment, the front terminal **41** includes two branches **46**. Each branch **46** is formed so as to project upward from the externally arranged portion **44**, in other words, the branch **46** is formed by branching of the terminal **40** at an upper portion of the externally arranged portion **44**. That is, in the front terminal **41**, the connecting branch **46***a* to be described later is formed from an upper right portion of the externally arranged portion **44**, and the non-contact branch **46***b* to be described later is formed from an upper left portion of the externally arranged portion **44**. The branch **46** is not limited to such a shape, and for example, the branch **46** may be formed by branching from the middle of the externally arranged portion **44**, or may be formed by branching from the middle of the insertion portion **45**. As illustrated in FIG. **4**A, it is preferable that a proximal end (a base portion where the terminal **40** branches) of the branch **46** (the connecting branch **46***a* and non-contact branch **46***b*) is located outside the core **30** as in the present embodiment.

[0085] As illustrated in FIG. **2**, a part of each of branches **46** is inserted into the core **30**. In the present embodiment, a substantially entire branch **46** is inserted into the core **30**, and a part on the proximal end side of the branch **46** is arranged outside the core **30**. In the present embodiment, the branch **46** is the same as the insertion portion **45**.

[0086] In the present embodiment, the other terminal (the rear terminal **42**) also branches to form the branch **46** similarly to the front terminal **41**, and a part of the branch **46** is inserted into the core **30**. The front terminal **41** and the rear terminal **42** have mirror-symmetrical shapes.

[0087] As illustrated in FIG. **2**, one of the branches (the connecting branch **46***a*) is directly conducted with the coil **20**, and at least one of the other branches (non-contact branch **46***b*) is indirectly conducted with the coil **20** via the one of the branches (the connecting branch **46***a*). Here, the fact that the non-contact branch **46***b* is indirectly conducted with the coil **20** means that they are conducted with each other via the connecting branch **46***a*. In other words, the entire non-contact branch **46***b* is not in contact with the coil **20**. In the present embodiment, the non-contact branch **46***b* and the coil **20** are conducted with each other via the connecting branch **46***a* and the externally arranged portion **44**.

[0088] As illustrated in FIG. **4**B, the other branch (the non-contact branch **46***b* illustrated in FIG. **4**A) and the conductor shield **10** are in contact with and joined to each other by brazing or welding. In the present embodiment, the non-contact branch **46***b* and the conductor shield **10** are brazed to each other by the solder **50**. The solder **50** enters a gap between the front terminal **41** and the conductor shield **10**, and is also arranged between the end face **12***b* of the front lip **12** and the curved surface **44***d* of the front terminal **41** as illustrated in FIG. **6**B, for example.

[0089] In the present embodiment, the connecting branch **46***a* is in contact with the conductor shield **10**, but it is also possible that this is not in contact therewith. It is preferable that the connecting branch **46***a* and the conductor shield **10** are not joined. In the present embodiment, the solder **50** is not arranged between contact portions **13** and **13** described later, but this may also be arranged.

[0090] By joining the non-contact branch **46***b* that is not directly conducted with the coil **20** to the conductor shield **10** in this manner, it is not necessary to join the connecting branch **46***a* that is directly conducted with the coil **20** to the conductor shield **10**. As a result, a thermal load on the connecting branch **46***a* can be minimized.

[0091] In place of the present embodiment, an aspect in which the connecting branch **46***a* and the conductor shield **10** are joined to each other and the non-contact branch **46***b* and the conductor shield **10** are not joined may be adopted.

Second Embodiment

[0092] The present embodiment is an embodiment different from the first embodiment only in a manner of joining a conductor shield **10** to a front terminal **41**, and the conductor shield **10**, a coil **20**, a core **30**, and a terminal **40** of an inductor **100** in the present embodiment are common to those in the first embodiment.

[0093] In the present embodiment, the conductor shield **10** and one terminal (a front terminal **41**) are joined to each other by welding or brazing.

[0094] Also in the present embodiment, as in the first embodiment, one terminal (the front terminal **41**) includes two or more branches **46** formed by branching of one end, and a part of each of the branches **46** is inserted into the core **30**. As illustrated in FIG. **7**, each of the two or more branches **46** (a connecting branch **46***a* and a non-contact branch **46***b* illustrated in FIG. **4**A) and the conductor shield **10** are joined to each other. In a case where the front terminal **41** and the conductor shield **10** are brazed to each other, solder **50** for joining the connecting branch **46***a* to the conductor shield **10** and solder **50** for joining the non-contact branch **46***b* to the conductor shield **10** may be continuous or divided as described later.

[0095] In this manner, since each of the two or more branches **46** is joined to the conductor shield **10**, the front terminal **41** and the conductor shield **10** are firmly connected.

[0096] In the present embodiment, as in the first embodiment illustrated in FIG. **4**A, one terminal (the front terminal **41**) is in contact with the conductor shield **10** at each of two or more contact portions **13** separated from each other. In other words, in one contact portion **13***a*, the connecting branch **46***a* is in contact with the conductor shield **10**, and in another contact portion (in this embodiment, in which the terminal **40** has two contact portions **13**, it refers to the other contact portion **13***b*), the non-contact branch **46***b* is in contact with the conductor shield **10**. The contact portion **13** refers to a portion of the front terminal **41** in contact with the conductor shield **10** and a part in the vicinity thereof, and in the present embodiment, refers to a part of a terminal upper surface **45***a* of the front terminal **41** and a portion in the vicinity thereof. In other words, the contact portion **13** in the present embodiment is a part on a proximal end side of the branch **46** (a front end of an insertion portion **45** and a bent portion between the insertion portion **45** and an externally arranged portion **44**).

[0097] As illustrated in FIG. **7**, a brazing material (solder **50**) is arranged between the one contact portion **13***a* (refer to FIG. **4**A) and the other contact portion **13***b* (refer to FIG. **4**A). That is, a part of the solder **50** is arranged between facing end faces **13***c* and **13***c* (refer to FIG. **4**A) where the contact portions **13** face each other. In other words, as illustrated in FIG. **4**A, a cavity surrounded by the one contact portion **13***a*, an upper end face **44***a* (refer to FIG. **2** or **6**B) of the front terminal **41** forming a recess **47** and a projection **48**, and the other contact portion **13***b* is formed on the terminal **40**, and the solder **50** enters and accumulates in the cavity as illustrated in FIG. **7**. More specifically, the solder **50** is in contact with each of the upper end face **44***a* of the front terminal **41** (refer to FIG. **6**B), an end face **12***b* of a front lip **12**, and the facing end faces **13***c* of the contact portions **13** (refer to FIG. **4**A).

[0098] In the present embodiment, as illustrated in FIGS. **4**A and **7**, the solder **50** joins the upper end face **44***a* (refer to FIG. **6**B) of the front terminal **41** to the end face **12***b* of the front lip **12**. That is, the one contact portion **13***a*, the other contact portion **13***b*, and a portion between the one contact portion **13***a* and the other contact portion **13***b* in one terminal (the front terminal **41**) are all joined to the conductor shield **10** by the brazing material (solder **50**). The solder **50** that joins the one contact portion **13***a*, the other contact portion **13***b*, and a portion between the one contact portion **13***a* and the other contact portion **13***b* in one terminal (the front terminal **41**) to the conductor shield **10** are arranged continuously.

[0099] Since the solder **50** is arranged between the contact portions **13** and **13**, the solder **50** can be accumulated on the upper end face **44***a* of the front terminal **41**, particularly in the recess **47**, and the liquid solder **50** can be prevented from flowing down when the front terminal **41** and the conductor shield **10** are brazed to each other.

[0100] The solder **50** is in contact with not only the curved surface **44***d* of the front terminal **41** but also the upper end face **44***a* on which the recess **47** and the projection **48** are formed, so that the solder **50** is in contact with the front terminal **41** in various directions. This prevents the solder **50** from being peeled off from the front terminal **41**.

[0101] In the present embodiment, a cross section (a cross section orthogonal to an extending direction of the solder, that is, right-left direction) of the solder **50** arranged between the contact portions **13***a* and **13***b* has a larger dimension and a different shape than the cross section of the solder **50** arranged on an upper edge of the contact portion **13**. That is, a thickness (dimension in a front-rear direction) of the solder **50** arranged between the contact portions **13***a* and **13***b* is thicker than the thickness of the solder **50** arranged in the vicinity of the contact portion **13**. Therefore, even in a case where a thermal load over time is applied, the solder **50** arranged between the contact portions **13***a* and **13***b* is less likely to be cracked, and joining between the conductor shield **10** and the terminal **40** can be maintained.

Third Embodiment

[0102] The present embodiment illustrated in FIG. **8** is different from the first or second embodiment only in a manner of placing a conductor shield **10**. The conductor shield **10**, a coil **20**, a core **30**, a terminal **40**, and solder **50** of an inductor **100** in the present embodiment are common to those of the inductor **100** in the first or second embodiment, and a shape in a top view is substantially common to that of the inductor **100** in the first embodiment illustrated in FIG. **3**A. FIG. **8** is a longitudinal sectional view of the inductor **100** according to a third embodiment. A position and a viewing direction of the longitudinal section illustrated in FIG. **8** are common to arrow VI-VI illustrated in FIG. **3**A according to the first embodiment.

[0103] In the present embodiment, as illustrated in FIG. **8**, a part (a core contact portion **11***b*) of a cover portion **11** is in contact with the core **30**, and a hollow portion **60** is provided between another part (separation portion **11***c*) of the cover portion **11** and a part of a first surface (upper surface **30***c*). More specifically, in the present embodiment, a length of a front lip **12** is longer than a distance to a terminal upper surface **45***a* of a front terminal **41** with reference to an upper surface **30***c* of the core **30**. Therefore, as a result of abutment between the front lip **12** and the front terminal **41**, a part on a second surface side in a cover inner surface **11***a* (refer to FIG. **6**A) and a part of the upper surface **30***c* of the core **30** are separated from each other. At that time, one end on an inner side in a terminal projecting direction of an end face **12***b* of the front lip **12** (for example, an inner side in the terminal projecting direction of a rectangular end face **12***b*) is in contact with the front terminal **41**. The front lip **12** is in contact with the terminal upper surface **45***a* or a curved surface **44***d* of the front terminal **41**. Note that, in FIG. **8**, a height of the hollow portion **60** is exaggerated. A maximum height of the hollow portion **60** (dimension to a highest point of the hollow portion **60** with reference to the upper surface **30***c* of the core **30**) is preferably smaller than a thickness of the conductor shield **10** (cover portion **11**).

[0104] The core contact portion **11***b* in contact with the core **30** is a part on a rear side of the cover portion **11**, and the separation portion **11***c* is a part on a front side (second surface side) than the core contact portion **11***b* of the cover portion **11**. In the present embodiment, the core contact portion **11***b* is in contact with a corner, which is a boundary between the upper surface **30***c* and a back surface **30***f* of the core **30**.

[0105] In the present embodiment, in addition to the core contact portion **11***b*, the conductor shield **10** is in contact with a lower end of an inner surface of a rear lip **14** and a part of a lip inner surface **12***a* (refer to FIG. **6**B) of the front lip **12**. The lower end of the inner surface of the rear lip **14** is in contact with the back surface **30***f* of the core **30**, and the lip inner surface **12***a* (refer to FIG. **6**B) of the front lip **12** is in contact with a corner, which is a boundary between the upper surface **30***c* and a front surface **30***e* of the core **30**.

[0106] The hollow portion **60** is a space defined by the separation portion **11***c*, the lip inner surface **12***a* of the front lip **12**, the first surface (upper surface **30***c*), and inner surfaces of a right lip **15** and a left lip **16**.

[0107] In place of the present embodiment, the hollow portion **60** may be provided without the cover inner surface **11***a* being in contact with the core **30**. For example, an aspect may be adopted in which the cover inner surface **11***a* is not in contact with the corner, which is the boundary between the upper surface **30***c* and the back surface **30***f* of the core **30**, and the lower end of the rear lip **14** is in contact with the core **30**.

[0108] Since there is the hollow portion **60** between the core **30** and the cover portion **11**, the core **30** and the cover portion **11** can be insulated from each other by air in the hollow portion **60** without applying an insulating material to a surface of the core **30** covered with the cover portion **11** or the cover inner surface **11***a*.

[0109] The cover portion **11** is downwardly inclined so as to approach the first surface (the upper surface **30***c*) from another part of the cover portion **11** (the separation portion **11***c*) toward the part of the cover portion **11** (the core contact portion **11***b*). Downward inclination does not necessarily mean the downward inclination in an actual vertical relationship, but means the inclination approaching the first surface with reference to the first surface. In other words, the cover portion **11** intersects with the first surface. A thickness (dimension in an up-down direction) of the hollow portion **60** gradually increases toward the second surface (the front surface **30***e*) and gradually decreases toward the back surface **30***f* of the core **30**.

[0110] As described above, by making the length of the front lip **12** longer than the distance from the upper surface **30***c* of the core **30** to the front terminal **41**, and arranging the conductor shield **10** such that the cover portion **11** is downwardly inclined, the front lip **12** can surely contact the front terminal **41**.

Fourth Embodiment

[0111] As illustrated in FIG. **9**, the present embodiment is different from the first, second, or third embodiment in that not only a conductor shield **10** but also a second conductor shield **70** is provided. A coil **20**, a core **30**, a terminal **40**, and solder **50** in an inductor **100** of the present embodiment are common to those of the first, second, or third embodiment.

[0112] The inductor **100** according to the present embodiment includes a second conductor shield (the second conductor shield **70**). The second conductor shield **70** covers at least a part of an upper surface or a side surface of the core. The second conductor shield **70** and another terminal (a rear terminal **42**) are directly conducted with each other, and the second conductor shield **70** and one terminal (a front terminal **41**) are indirectly conducted with each other via the coil **20**. The fact that the second conductor shield **70** and the rear terminal **42** are directly conducted with each other means that the second conductor shield **70** is conducted with the rear terminal **42** without the coil **20**. The second conductor shield **70** can be conducted with the rear terminal **42** via a member other than the coil **20** (for example, a conductive wire and the like).

[0113] As illustrated in FIGS. **11**A and **11**B, the second conductor shield **70** includes a rear lip **72** that covers a part of a third surface (a back surface **30***f* of the core **30** in the present embodiment) to which an externally arranged portion **44** of the rear terminal **42** extends, a right lip **73** that covers a right surface **30***h* of the core **30**, and a left lip **74** that covers a left surface **30***g* of the core **30**.

[0114] As illustrated in FIGS. **10** and **11**B, the rear lip **72** of the second conductor shield **70** is in contact with the rear terminal **42**. Similarly to the front lip **12** of the conductor shield **10**, the rear lip **72** is in surface contact with the rear terminal **42** at a lower end face. Alternatively, a contact portion between the rear lip **72** and the rear terminal **42** may be substantially a line or a point.

[0115] In the present embodiment, as illustrated in FIG. **11**A, the conductor shield **10** and the second conductor shield **70** cover only a part of a first surface (an upper surface **30***c* of the core **30**). Specifically, the conductor shield **10** covers a front half of the upper surface **30***c* and does not cover a rear half of the upper surface **30***c*. The second conductor shield **70** covers the rear half of the upper surface **30***c* and does not cover the front half. More specifically, the conductor shield **10** and the second conductor shield **70** have the same shape and dimension, and areas covered with the conductor shield **10** and the second conductor shield **70** on the upper surface **30***c* are approximately the same.

[0116] In place of the present embodiment, a dimension of a cover portion **11** of the conductor shield **10** and a dimension of a second cover **71** that covers the first surface of the second conductor shield **70** may be larger or smaller. Either the conductor shield **10** or the second conductor shield **70** may cover the surface center of the upper surface **30***c*, and either the conductor shield **10** or the second conductor shield **70** may overlap an end face of the coil **20** as seen in a winding axis direction of the coil **20**.

[0117] In the present embodiment, as described above, the conductor shield **10** covers a front side of the upper surface **30***c* of the core **30** and the second conductor shield **70** covers a rear side, but there is no limitation. For example, the conductor shield **10** may cover a right side of the upper surface **30***c* of the core **30**, and the second conductor shield **70** may cover a left side.

[0118] As illustrated in FIG. **10**, in the present embodiment, the second cover **71** and the first surface (the upper surface **30***c*) are substantially parallel to each other, and a substantially entire inner surface of the second cover **71** is in contact with the upper surface **30***c*. A part of the second cover **71** and the core **30** may be in contact with each other, and a hollow portion may be provided between another part of the second cover **71** and a part of the upper surface **30***c*. In a case where the hollow portion is provided, one end on the front side of the second cover **71** is in contact with the upper surface **30***c* of the core **30**, and the second cover **71** is downwardly inclined with respect to the first surface (the upper surface **30***c*) from one end on the third surface (the back surface **30***f*) side toward the other end on the second surface (the front surface **30***e*) side.

[0119] In the present embodiment, as illustrated in FIG. **10**, a substantially entire cover portion **11** of the conductor shield **10** is in contact with the front half of the upper surface **30***c* of the core **30**. In a case where the hollow portion is provided between the conductor shield **10** and the core **30**, one end on the rear side of the conductor shield **10** is in contact with the upper surface **30***c* of the core **30**.

[0120] The second conductor shield **70** and the rear terminal **42** are joined by welding or brazing. As an aspect of joining, similarly to the joining between the conductor shield **10** and the front terminal **41**, it is possible that the rear terminal **42** includes two or more branches **46**, and each of the two or more branches **46** is joined to the second conductor shield **70**, or only one branch **46** is joined to the conductor shield **10**.

[0121] Similarly to an arrangement relationship between the conductor shield **10** and the front terminal **41**, it is preferable that the inner surface of the rear lip **72** that covers the back surface **30***f*, which is the third surface, is arranged inside the inner surface of the rear terminal **42** along the back surface **30***f* in plan view. It is preferable that a part of the third surface covered with the second conductor shield **70** is formed inside another part of the third surface covered with the rear terminal **42** in plan view. As a result, the second conductor shield **70** and the rear terminal **42** are brought into surface contact with each other and are conducted excellently.

[0122] The conductor shield **10** and the second conductor shield **70** are separated from each other. A sufficient creeping distance is maintained so that the conductor shield **10** and the second conductor shield **70** are not directly conducted. In the present embodiment, the end face facing the rear of the conductor shield **10** and the end face facing the front of the second conductor shield **70** face each other so as to be separated from each other. The conductor shield **10** and the second conductor shield **70** are arranged such that their respective end faces face each other, and a distance between the conductor shield **10** and the second conductor shield **70** is substantially uniform.

[0123] In the present embodiment, as illustrated in FIG. **11**B, the length of the rear lip **72** can be made longer than that of the first, second, and third embodiments. As a result, the leakage magnetic flux can be blocked in a wider area of the back surface **30***f* of the core **30**.

[0124] Note that, the present invention is not limited to the above-described embodiments, and includes various modifications, improvements and the like as long as the object of the present invention is achieved.

[0125] Following modifications can be appropriately combined.

[0126] In the above-described embodiment, the conductor shield **10** covers a part of the surface of the core **30**, but there is no limitation, and this may cover the entire surface of the core **30**. For example, the conductor shield **10** may have a rectangular parallelepiped shape including a cavity that can enclose the entire core **30**, in which only the mounting portion **43** is exposed to the outside of the conductor shield **10**. In this case, a sufficient creeping distance is maintained so that the conductor shield **10** and the rear terminal **42** are not directly conducted without the coil **20**.

[0127] It is possible that the front lip **12** is not in contact with the front terminal **41**. In this case, the front lip **12** is conducted with the front terminal **41** via a separate member. For example, the front lip **12** and the front terminal **41** are joined by the solder **50**, and the front lip **12** is conducted with the front terminal **41** via the solder **50**.

[0128] In the above-described embodiment, the terminal **40** including the branch **46** has been exemplified, but there is no limitation. The terminal **40** may be in contact with the conductor shield **10** at one contact portion **13** without including the branch **46**. In a case where the front terminal **41** is joined to the conductor shield **10** at one contact portion, the front terminal **41** may be joined to the conductor shield **10** in the entire contact portion **13**, and the front terminal **41** may be joined to the conductor shield **10** in a part of the contact portion **13** and not joined to the conductor shield **10** in another part of the contact portion **13**.

[0129] In the above-described embodiment, the aspect in which the core **30** is integrally formed has been described, but there is no limitation, and the core **30** may include a plurality of members. For example, the core may be divided into an upper core and a lower core with the step surface **30***e***1** (refer to FIG. **6**B) provided in the core **30** to be described later as a boundary. Alternatively, the core **30** may be a pot core. For example, a core that covers the peripheral surface and one end face of the coil **20**, a columnar core inserted through the center of the coil **20**, and a plate-shaped core that covers the other end face of the coil **20** may be combined to form the core **30**. In this case, for example, the conductor shield **10** may be arranged so as to cover an upper side of the plate-shaped core.

[0130] The above embodiment includes the following technical ideas.

[0131] (1) An inductor including: a coil; a core that encloses the coil; a pair of terminals conducted with the coil; and a conductor shield that covers a surface of the core, in which [0132] the conductor shield covers at least a part of an upper surface or a side surface of the core, [0133] the conductor shield is directly conducted with any one terminal of the pair of terminals, and [0134] the conductor shield is indirectly conducted with the other terminal via the coil.

[0135] (2) The inductor according to (1), in which [0136] the core includes a first surface to which an end face of the coil faces, and [0137] the conductor shield includes a cover portion that covers at least a part of the first surface.

[0138] (3) The inductor according to (1) or (2), in which [0139] the core includes a second surface along which the one terminal extends, [0140] a part of the conductor shield covers a part of the second surface, and [0141] the conductor shield that covers the second surface is in contact with the one terminal.

[0142] (4) The inductor according to (3), in which [0143] an inner surface of a part of the conductor shield that covers the second surface is arranged inside an inner surface along the second surface of the one terminal.

[0144] (5) The inductor according to (4), in which [0145] a part covered with the conductor shield in the second surface is arranged inside another part covered with the one terminal in the second surface.

[0146] (6) The inductor according to any one of (2) to (5), in which [0147] a part of the cover portion is in contact with the core, and [0148] a hollow portion is provided between another part of the cover portion and a part of the first surface.

[0149] (7) The inductor according to (6), in which [0150] the cover portion is downwardly inclined so as to approach the first surface from the another part of the cover portion toward the part of the cover portion.

[0151] (8) The inductor according to any one of (1) to (7), in which [0152] the conductor shield is joined to the one terminal by welding or brazing.
[0153] (9) The inductor according to (8), in which [0154] the one terminal includes two or more branches formed by branching of one end, [0155] a part of each of the branches is inserted into the core, [0156] one of the branches is directly conducted with the coil, [0157] at least one of the other branches is indirectly conducted with the coil via the one of the branches, and [0158] the one of the other branches are in contact with and joined to the conductor shield.
[0159] (10) The inductor according to (8), in which [0160] the one terminal includes two or more branches formed by branching of one end, [0161] a part of each of the branches is inserted into the core, and [0162] each of the two or more branches is joined to the conductor shield.
[0163] (11) The inductor according to (10), in which [0164] the one terminal is in contact with the conductor shield at each of two or more contact portions separated from each other, [0165] a brazing material is arranged between one of the contact portions and another of the contact portions, and all of the one contact portion, the another contact portion, and a portion between the one contact portion and the another contact portion of the one terminal are joined to the conductor shield with the brazing material.
[0166] (12) The inductor according to (1) to (11), including: [0167] a second conductor shield, in which [0168] the second conductor shield covers at least a part of an upper surface or a side surface of the core; [0169] the second conductor shield is directly conducted with the other terminal; [0170] the second conductor shield is indirectly conducted with the one terminal via the coil; and [0171] the conductor shield and the second conductor shield are separated from each other.
[0172] (13) An inductor, in which a length of a part of the conductor shield that covers the second surface is equal to or more than a distance to the one terminal with reference to the first surface.
[0173] (14) An inductor, in which at least a part of a partial end face that covers the second surface of the conductor shield is in surface contact with the one terminal.
[0174] (15) The inductor according to (14), in which the terminal projects outward from the core, a part of an inner side of the end face is in surface contact with the one terminal in a projecting direction of the terminal, and another part of an outer side in the projecting direction faces a curved surface of the one terminal that is bent.
[0175] (16) An inductor, in which a distance between an inner surface of a part that covers the second surface in the conductor shield and an inner surface of the one terminal is equal to or more than ¼ of a thickness of the part of the conductor shield that covers the second surface, and is equal to or less than the thickness of the part of the conductor shield that covers the second surface.
[0176] (17) The inductor according to (15), in which a brazing material that joins the conductor shield and the one terminal is arranged between an end face of the conductor shield and the curved surface of the one terminal.
[0177] (18) The inductor according to (9), in which the one branch is a non-joined portion of the conductor shield and the one terminal.
[0178] (19) The inductor according to (11), in which the one contact portion, the another contact portion, and a brazing material that joins the one contact portion and the another contact portion in the one terminal are continuous.

Claims

1. An inductor comprising: a coil; a core that encloses the coil; a pair of terminals conducted with the coil; and a conductor shield that covers a surface of the core, wherein the conductor shield covers at least a part of an upper surface or a side surface of the core, the conductor shield is directly conducted with any one terminal of the pair of terminals, and the conductor shield is indirectly conducted with the other terminal via the coil.
2. The inductor according to claim 1, wherein the core includes a first surface to which an end face

of the coil faces, and the conductor shield includes a cover portion that covers at least a part of the first surface.

3. The inductor according to claim 1, wherein the core includes a second surface along which the one terminal extends, a part of the conductor shield covers a part of the second surface, and the conductor shield that covers the second surface is in contact with the one terminal.

4. The inductor according to claim 3, wherein an inner surface of a part of the conductor shield that covers the second surface is arranged inside an inner surface along the second surface of the one terminal in plan view.

5. The inductor according to claim 4, wherein a part covered with the conductor shield in the second surface is arranged inside another part covered with the one terminal in the second surface in plan view.

6. The inductor according to claim 2, wherein a part of the cover portion is in contact with the core, and a hollow portion is provided between another part of the cover portion and a part of the first surface.

7. The inductor according to claim 6, wherein the cover portion is downwardly inclined so as to approach the first surface from the another part of the cover portion toward the part of the cover portion.

8. The inductor according to claim 1, wherein the conductor shield is joined to the one terminal by welding or brazing.

9. The inductor according to claim 8, wherein the one terminal includes two or more branches formed by branching of one end, a part of each of the branches is inserted into the core, one of the branches is directly conducted with the coil, at least one of the other branches is indirectly conducted with the coil via the one of the branches, and the one of the other branches are in contact with and joined to the conductor shield.

10. The inductor according to claim 8, wherein the one terminal includes two or more branches formed by branching of one end, a part of each of the branches is inserted into the core, and each of the two or more branches is joined to the conductor shield.

11. The inductor according to claim 10, wherein the one terminal is in contact with the conductor shield at each of two or more contact portions separated from each other, and a brazing material is arranged between one of the contact portions and another of the contact portions, and all of the one contact portion, the another contact portion, and a portion between the one contact portion and the another contact portion of the one terminal are joined to the conductor shield with the brazing material.

12. The inductor according to claim 1, further comprising: a second conductor shield, wherein the second conductor shield covers at least a part of an upper surface or a side surface of the core; the second conductor shield is directly conducted with the other terminal; the second conductor shield is indirectly conducted with the one terminal via the coil; and the conductor shield and the second conductor shield are separated from each other.