

Description**Electronic component and method for fixing the same**

The invention relates to an electronic component, especially a coil and a method for its manufacture.

Coils with coil cores are often required in electronics. They are implemented and fixed in components, printed circuit boards or in other arrangements. Placement and fixing often takes place with the help of devices that grasp the coils and place them at the required place. After placing, they can, for instance, automatically be soldered to establish the electrical connection.

When moving the coil with the help of automatic appliances very high speeds can occur and especially also jerky accelerations. Upon the occurrence of jerky accelerations the danger exists that the coil cores may be thrown out of the coil winding. Commonly, the coil cores are a bit longer than the coil winding, but grasping with automatic appliances generally occurs in the middle of the longitudinal extension of the coil -thus on the coil winding.

To enable grasping on the coil winding, it is already known to attach a small plate made of plastic, with the help of an adhesive, which can involve an encapsulating material to be applied on the top side of the coil winding (DE 9410532).

Embodiments of the invention provide an electronic component in such a manner that it is particularly suitable for automatic assembly.

Embodiments of the invention propose a component with the features mentioned below.

According to the first aspect of the invention, there is provided an electronic component that comprises a coil with a coil core and a coil winding surrounding the coil core with at least two connection ends and is formed for automatic insertion and features a holding element that consists of plastic and is injection-moulded on the electronic component, and is formed as an action point for a gripping device, wherein the holding element acts both on the coil core as well as on at least a point on a winding of the coil winding on which a gap is provided, between two adjoining windings, in the longitudinal direction of the coil.

According to the second aspect of the invention, there is provided a process for fixing an electronic component formed as coil with a coil core, wherein the windings of the coil winding are provided with a gap at least at one point, a holding element is injection moulded on the point of the gap between the two windings and the windings themselves, an action surface for a gripping device is formed on the holding element, and the component is conveyed to its assembly point with the help of the gripping device on the acting surface.

The component may be grasped by using a grasper on the holding element, and moved to the assembly point.

The electronic component may be a capacitor, for example. Particularly, the invention is suitable for fastening coils.

In the normal case the windings of the coil lie adjacent to one another in order to occupy little space as possible. Now, it is provided, according to embodiments of the invention that, at a point between two sections of winding or also between two adjacent windings, a gap is provided for instance in longitudinal direction of the coil. Through this gap the coil core is open outwards so that the holding element can be connected both with the coil core as well as with the two adjacent coil windings.

The holding element made of plastic is injection-molded at this point. It connects itself with the coil core and with the neighboring windings. Through this, a permanent connection between the coil core and the coil winding established so that the initially mentioned difficulties can no longer occur.

For an automatic assembly, the coils are generally formed such that they allow one to see which side of the coil is meant to be the assembly side on the printed circuit board. This can be identified, for instance, in that the two connection ends of the coil winding run tangentially to the coil core and lie in one plane. Embodiments of the invention now propose that the holding element is injection-molded on the side turned away from the assembly side of the coil.

Thus, expressed otherwise, this allows that the holding element is injection molded from this side. This results in that the holding element may also be used to form an action point for a gripping device, for instance for a suction pipette.

According to further embodiments of the invention, it can be provided that the holding element extends at least over a part of the circumference of the coil.

In yet another further embodiment of the invention, it can be provided that the holding element only extends over a part of the length of the coil. Thus, the rest of the coil, particularly of the coil winding, remains free of the material of the holding element so that no restrictions occur with regard to the heat dissipation capability.

It can, however, also be provided that the holding element extends over an entire circumference of the coil so that it is therefore injection-molded around the coil.

In yet another further embodiment of the invention, it can be provided that the holding element features a plane surface on the side turned away from the assembly side of the coil. This plane surface is meant and is suitable for being held by means of a grasper.

According to embodiments of the invention, it can likewise be provided that the holding element is injection-molded from a plastic that develops an adhesive effect at higher temperatures, for instance at a temperature that corresponds to the soldering temperature. This leads to the effect that, during its electrical connection via the soldering process, the coil is concurrently additionally connected mechanically with the printed circuit board at a further point.

For the manufacture of the coil, embodiments of the invention propose that first from the wire the coil winding is made in such a manner that said coil features a gap at least at one point between two adjacent windings in the longitudinal direction. Thereafter, in this coil winding, a coil core is inserted and the unit comprising the coil winding and the core is introduced into an injection die. In this injection die, many similar units of coil winding and coil core can be introduced. Finally, at the said point of the gap between the two windings and the two adjacent windings, the holding element itself is injection-molded.

Further features, details, and preferences of the invention are derived from the claims and the abstract, whose wording refers to the content of the description, and to the following description of a preferred embodiment as well as to the drawing. The following figures show:

Figure 1: a view of a coil winding with a coil core from the direction turned away from the assembly side of the coil;

Figure 2: the view of the coil of Figure 1 from the bottom in Figure 1;

Figure 3: the view of the coil corresponding to Figure 2 with an attached holding element;

Figure 4: an illustration corresponding to Figure 3 for the second embodiment.

Figure 5: a plan view of a coil to be vertically mounted.

Figure 6: a side view of the coil according to Figure 5 with a partially sectioned illustration of the holding element.

Figure 1 shows a coil with a coil core 1, for instance made of ferrite. The coil core 1 is formed as a circular cylindrical rod. It contains two plane end faces 2. The coil core 1 is surrounded by a coil winding 3, which features numerous adjacent coil windings 4. The two ends 5, 6 of the coil winding 3 are tangentially led away from the coil core 1. The two ends 5, 6 can also be longer, the illustration is only schematically considered. They lie in one plane. This plane depicts the assembly side of the coil.

The windings 4 of the coil winding 3 are wound at a point 7 such that they feature a gap in the longitudinal direction of the coil. This forms a gap through which a part of the surface of the coil core 1 is visible.

Figure 2 shows the view of the coil of Figure 1 from below in Figure 1, thus from a direction offset by 90°. Here, one sees how the gap between two adjacent windings 4 occurs. The pitch of the windings is enlarged at this point and finally led back to the normal value.

The unit depicted in Figures 1 and 2 of the coil core 1 and coil winding 3 is placed in an injection die, together with a plurality of other similar units. In this injection die, a holding element 8 is injection-molded onto the point 7 of the gap between two adjacent windings 4 of the coil winding 3. The top side 9 of the holding element 8 as visible in Figure 3 is formed plane. In longitudinal direction, the holding element 8 extends over the gap between adjacent windings and at least over the two adjacent windings themselves, preferably still up into the depression between the next windings. The holding element 8 is made of injected plastic and is connected with the core 1 and the coil windings. Through this the coil winding 3 is also connected with the core 1. As for the embodiment of Figure 3 the holding element 8 extends in the circumferential direction only via a part of the coil.

Figure 4 depicts an embodiment in which the holding element 18 is injection molded around the entire circumference of the coil. Again, the side of the holding element 18 is turned away from the assembly side, at the bottom in Figure 4, where it is provided with a plane surface 9 on which a gripper can act.

In the case of both embodiments the holding element 8, 18 only extends over a part of the length of the coil so that the rest of the coil windings 3 remain free and can dissipate their heat content.

The attachment of a holding element 8, 18 on an electronic component was described using a coil as an example. The attachment of such a holding element can also occur for other electronic components.

The holding element 18 depicted in Figure 4 can be injection-molded from a plastic that develops an adhesive effect at a temperature corresponding to the soldering temperature. When the coil is placed on the printed circuit board and then finally soldered, with the help of the holding element 18 it will be bonded together with the surface of the printed circuit board. This leads to a particularly good mechanical safety of the coil on the printed circuit board. This type of connection by means of a holding element made of a plastic that generates an adhesive effect at a higher temperature can also find application for other electronic components, but not for coils with a coil core.

What was depicted in Figures 1 to 4 for a horizontal configuration of coils is obviously also possible for the upright configuration of coils. In the case of horizontal configuration the axis of the coil core and the coil winding is aligned parallel to the surface on which the coil is mounted. In the case of upright configuration the axis is aligned perpendicularly to the surface. Even with the upright configuration it is possible to align the holding

element as it is depicted in Figures 1 to 3. Even then can a grasper hold the contact surface 9 of the holding element and place the coil at the right place.

It is, however, likewise possible to attach the holding element at a different point. This should be depicted with reference to Figure 5 and Figure 6. Figure 5 shows a face view of a coil in which the face surface 2 of coil core 1 is visible. The two ends 5, 16 of the coil winding are arranged differently here contrary to how this was depicted in the preceding embodiments. While connection end 5 still runs tangentially to the coil core 1, the connection end 16 is aligned radially outwards and from there it is bent downwards; see the side view of Figure 6. Whilst Figure 5 still shows the coil with coil core prior to the injection molding of the holding element, Figure 6 shows a side view with a holding element 28 injection-molded on it, which is depicted here in a sectional view. As one can still derive from Figure 5, here the winding 4 sections of the coil winding are arranged such that the core 1 between them is free. One can injection mould a holding element 28 at this point which then extends laterally so far that it then overlaps the top-most coil winding 4. This also leads to having the coil winding 3 fixed against displacement on the core 1.

The holding element 28 can enclose the face end of the coil, for instance, when turned away from the mounting surface around the entire circumference so that it forms a kind of cover. However, it can also be sufficient that this holding element 28 only extends in the section of a diameter above the face end, so that free parts remain on the right and left side.

Also in the type of configuration of Figure 6, the holding element, in the embodiment according to Figure 4, can similarly reach up to a point on the

lower face surface 2 in Figure 6 if one intends to attain the same fixing type as in the case of the embodiment according to Figure 4.

What was depicted with reference to Figures 4 to 6 as an example for one coil can also be applied to another electronic component, for instance, to capacitors that likewise feature connection ends, and in which the components can be mounted with both the help of a grasper as well as adhesion during soldering.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An electronic component that
comprises a coil with a coil core and a coil winding surrounding the coil core
with at least two connection ends and
is formed for automatic insertion and
features a holding element that
consists of plastic and
is injection-moulded on the electronic component, and
is formed as an action point for a gripping device, wherein the holding
element acts both on the coil core as well as on at least a point on a winding of the
coil winding on which a gap is provided, between two adjoining windings, in the
longitudinal direction of the coil.
2. The component according to claim 1, wherein, on at least one point between
two adjoining windings of the coil winding, a gap is provided in the longitudinal
direction of the coil, whereby the holding element is injection-moulded on the coil
core on said point of said gap between the windings, and at least said adjoining
windings of said coil winding, both overlapping said point in the longitudinal
direction.
3. The component according to claim 1 or claim 2, wherein the holding element
is disposed on the side of coil facing away from the assembly side of said coil.
4. The component according to any one of the preceding claims, wherein the
holding element extends over at least one part of the circumference of said
component.
5. The component according to any one of the preceding claims, wherein the
holding element extends only over a part of the length of said component.
6. The component according to any one of the preceding claims, wherein the
holding element extends around the entire circumference of said component.

7. The component according to any one of the preceding claims, wherein the holding element features a plane surface on the side of said component facing away from the assembly side.
8. The component according to any one of the preceding claims, wherein the holding element is injection moulded of plastic that acts adhesively at soldering temperature.
9. A process for fixing an electronic component formed as coil with a coil core, wherein
 - the windings of the coil winding are provided with a gap at least at one point,
 - a holding element is injection moulded on the point of the gap between the two windings and the windings themselves
 - an action surface for a gripping device is formed on the holding element, and
 - the component is conveyed to its assembly point with the help of the gripping device on the acting surface.
10. The process according to claim 9, wherein the holding element is injection moulded on the side of the component facing away from the assembly side of said component.
11. The process according to claim 9 or claim 10, wherein the holding element is injection moulded over at least a part of the circumference of the component.
12. The process according to any one of claims 9 to 11, wherein the holding element is injection moulded only over a part of the length of the component.
13. The process according to any one of the preceding claims, wherein the holding element is injection moulded all around the entire circumference of the component.
14. The process according to any one of claims 9 to 13, wherein the holding

element is provided with a plane surface on the side of the component facing away from the assembly side.

15. The process according to any one of claims 9 to 14, wherein the holding element is injection moulded of plastic that exhibits adhesive effect at a temperature that corresponds to the soldering temperature.

16. An electronic component substantially as hereinbefore described with reference to the accompanying drawings.

17. A process for fixing an electronic component substantially as hereinbefore described with reference to the accompanying drawings.

Abstract

Disclosed is an electronic component, especially a coil with a coil core, in which the turns of the coil winding are spaced apart from each other at least at one point in the longitudinal direction of the coil. A plastic retaining element which overlaps both the coil core and at least the two adjacent turns of the coil winding in a longitudinal direction is sprayed on in the area of said point, whereby a connection between the coil core and the coil winding is created at the same time. The retaining element can be sprayed around a closed circumference of the coil while covering only a portion of the coil in the longitudinal direction thereof. Preferably, the retaining element is placed approximately in the center relative to the longitudinal extension of the coil.
