CHIP CARRIER FOR A CHIP MODULE AND METHOD OF MANUFACTURING THE CHIP MODULE

The present invention relates to a chip carrier with a substrate and connection leads arranged on the substrate, wherein the connection leads are designed like stripes and extend parallel over the substrate. In addition, the invention relates to a chip module manufactured using the chip carrier, and a method of manufacturing such a chip module.

Chip modules are usually manufactured using chip carriers whose surface is provided with a printed circuit structure for connection with elevated contact metallizations of the chip. The use of printed circuit structures manufactured in etching processes does enable any printed circuit structures desired, in particular those with a complex design. However, just the provision or manufacture of the conventional chip carriers independently of the actual contacting process with the chip for manufacturing the chip module already requires a complex and correspondingly expensive procedure. The use of etching techniques requires an appropriate structure for the carrier layer of the substrate, which in addition to a so-called etch-stop layer must also be provided with a lacquer coating when using lithographic processes for defining the printed circuit structure.

Known from DE 195 41 039 A1 is a chip module with a chip carrier, in which the connection leads formed on an insulation layer extend in a stripe-like design and mutually parallel over the insulation layer of the substrate, and are each allocated to an elevated contact metallization of a chip. To manufacture the known chip module, the individual substrates of the chip carriers are arranged on a continuous substrate carrier, which is connected with the individual substrates via the connection leads extending continuously over the substrate carrier. In the known method,

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the film-like substrate carrier is used only to connect the connection leads with the substrate.

Proceeding from known prior art, the object of the invention is to provide a chip carrier for a chip module or a method of manufacturing a chip module, which exhibits a particularly simple design relative to the known chip modules, and hence opens the door to particularly cost-effective manufacture.

This object is achieved using a chip carrier with the features set forth in claim 1.

In the chip carrier according to the invention, the connection leads consist of electrically conductive connection strands placed on the substrate, and the substrate is formed by a carrier film.

Designing the connection leads as connection strands that are completely independent of the carrier film makes it possible not to have to manufacture the connection leads based on an expensive etching technique. Therefore, the chip carrier according to the invention consists of a combination of a carrier film and connection strands, which each represent independent elements in the initial state, so that no special technologies, e.g., the use of an etching process, are required for manufacturing the chip carrier, but rather a simple connecting or joining process, wherein the substrate is directly formed by the carrier film. Having the substrate serve as the carrier film also enables substrates with a particularly flat design.

In a particularly preferred embodiment of the chip carrier, the side of the carrier film opposite the connection strands is provided with at least one additional conductive strand, in which the insulating carrier film is

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arranged between the connection strands on the one hand and the additional conductive strand on the other, forming an intermediate layer.

Adding this at least one conductive strand on the opposite side of the carrier film yields a capacitor structure that is arranged in a parallel circuit with the chip after the connection strands have been contacted with a chip. Precisely in the area of transponder technology, this special configuration of the chip module gives rise to the special advantage when contacting the connection strands with a coil unit that the range of the transponder unit formed by combining the chip and coil unit can be distinctly increased.

In particular with respect to the automated manufacture of chip modules using the chip carriers, it proves advantageous to provide the connection strands at least sectionally with a connecting material coating for contacting with the contact metallizations of the chip, so that the chip can be contacted directly on the connecting strands after providing the substrate without any additional intermediate step. This connecting material coating can consist of a connecting solder coating, or a coating of electrically conductive adhesive or the like.

Providing the connection strands at least sectionally with a contact metallization for contacting with the elevated contact metallizations of the chip makes it possible to obtain especially high-quality, i.e., reliable, connections, in particular due to the surface quality of the connection strands as improved by the contact metallization. Otherwise, of course, connecting strands made out of copper or a copper alloy can be used to produce a direct connection with the contact metallizations of the chip, in particular if the contact metallizations of the chip exhibit a lead/tin alloy or similar alloys with a correspondingly low melting point.

If the connection strands of the chip carrier are connected with the terminals of the coil unit, the chip carrier can serve as the basic unit for manufacturing a transponder, wherein the basic unit need only be enhanced by contact with a chip.

Based on the chip module described above, it is also possible, as already mentioned above, to provide a transponder module in which the connection strands contacted with the contact metallizations of the chip are connected according to the invention with terminals of a coil unit.

In the chip module according to the invention, the contact metallizations of the chip are contacted with the top side of the connection strands of the chip carrier. In addition to the fact that the chip module can be manufactured with a simple flip-chip contact, this chip module structure offers the advantage of making the side of the substrate lying opposite the connection strands available for further applications.

If the connection strands contacted with the contact metallizations of the chip are additionally connected with the terminals of a coil unit, a transponder module with an especially simple structure is obtained.

The method according to the invention for manufacturing a chip module involves the following steps:

- applying at least two electrically conductive connection strands to one side of a carrier film, so that the connection strands extend parallel over the carrier film, and
- contacting contact metallizations of the chip with the connection strands, so that a contact metallization of the chip is contacted with a respective connection strand.

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As already emphasized at the outset while describing the structure of the chip module according to the invention, the manufacturing process is characterized by the lowest possible number of steps, due to the fact that the substrate provided with connection leads is realized via a simple combination of connection strands with a carrier film, and the type of contacting according to the invention enables a simple flip-chip contacting.

If the connection strands are contacted with the coil unit before being contacted with the chip, a first portion of the manufacturing process, which can also be executed independently of the subsequent contacting with the chip, yields an intermediate product in the form of a chip carrier, which can be directly used for manufacturing transponder units.

One particularly economic variant of the method according to the invention can be implemented if the connection strands are continuously applied to the carrier film, so that the connection strands and the carrier film are provided as continuous strands, and moved continuously toward each other in a contacting area with the generation of an adhesion.

If the carrier film is provided with window openings at defined distances before forming the contact area with the connection strands, so that the window openings in the subsequently formed contact area are covered by the connection strands while forming pocket-like contact receptacles, it becomes possible to manufacture a chip module even without the influence of a continuous process, in which the contact metallizations of the chip are contacted with the bottom side of the connection strands, and the chip itself is located on the side of the carrier film opposite the connection strands.

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Therefore, this method variant enables the manufacture of an especially flat or thin chip module.

A chip module with a capacitor structure can be manufactured in another method variant by placing at least one additional electrically conductive counter-strand on the side lying opposite the side intended for applying the connection strands. This process can take place before or after applying the connection strands on the carrier film.

One particularly easy and hence cost-effective way of implementing the method is made possible by applying the connection strands and/or at least one counter-strand on the carrier film in a lamination process.

In this connection, it is also advantageous to use a hot-melt coating to form an adhesion between the connection strands and/or the at least one counter-strand and the carrier film.

An embodiment of the chip module and a variant of the method of manufacturing the chip module shall be explained in greater detail below based on the drawings. Shown in:

Fig. 1 is a chip carrier for manufacturing a chip module, top view,

Fig. 2 is the chip carrier shown in Fig. 1 with a chip contacted thereupon to form a chip module;

Fig. 3 is a first embodiment of a chip module, sectional view;

Fig. 4 is a second embodiment of the chip module, sectional view;

Fig. 5 is a third embodiment of a chip module, sectional view;

Fig. 6 is an electrical equivalent circuit diagram for the substrate of the chip module shown in Fig. 5;

Fig. 7 is a diagrammatic view of a device for performing a variant of the method of manufacturing the chip module.

Fig. 1 shows a top view of a section of a chip carrier strand 10 with a carrier film 11 and connection strands 12 and 13 applied to one side of the carrier film 11.

Fig. 2 shows the chip carrier strand 10 depicted in Fig. 1 with numerous spaced chips 14 contacted on the chip carrier strand 10. As evident from Fig. 2, the chips 14 with their contact metallizations, also referred to as "bumps" in technical parlance, are contacted with connection strands 12, 13 in flip-chip technology in such a way that one bump 15 or 16 is allocated to a connection strand 12, 13 in an electrically conductive manner.

As indicated by separating lines 17 in Fig. 2, chip modules 18 are detached from the composite chip module held together by the chip carrier strand 10 via separating cuts through the chip carrier strand 10 after the chips 14 have contacted the chip carrier strand 10.

Fig. 3 shows a sectional view according to intersecting line III-III in Fig. 2. As evident, chip 14 is contacted in flip-chip technology with its bumps 15, 16 on the connection strands 12, 13 of the chip carrier 19 separated out of the chip carrier strand 10 along separating lines 17. In this case, the carrier film 11 forming the substrate of the chip carrier 19 consists of kapton, whose top side is covered with the connection strands 12, 13 made out of so-called E copper. To improve the surface quality of the

connection strands 12, 13, the latter are coated with a contact metallization in this case. Other electrically non-conductive materials can also be used for the chip carrier 19 or chip carrier strand 10, e.g., epoxy glass, polyester, polycarbonate and polyimide, wherein a flexible design of the carrier film 11, e.g., using polyimide, is advantageous, in particular when using a manufacturing process of the kind explained in greater detail below with reference to Fig. 7.

Fig. 4 shows a variant of a chip module 20 in which the chip 14 is contacted with a bottom side 22 of the connection strands 12, 13, as opposed to the chip module 18 shown in Fig. 3, where the chip 14 is contacted with a top side 21 of the connection strands 12, 13.

To this end, pocket-like contact receptacles 23, 24 are formed in the areas of the carrier film 11 of a chip carrier 28 covered by the connection strands 12, 13, and used to accommodate the bumps 15, 16 of the chip 14. Given the appropriate preparation of the surfaces of connection strands 12, 13, e.g., via contact metallization, the bumps 15, 16 can be directly contacted with the connection strands 12, 13, or a contacting process as shown in Fig. 4 can be performed, in which a separate bonding material, e.g., soldering material 25 situated between the bottom sides 22 of the connection strands 12, 13 and the bumps 15, 16 of the chip 14 is additionally provided.

Fig. 5 shows another embodiment of a chip module 26, in which, as opposed to the chip module 18 shown in Fig. 3, a counter-strand 27 is provided on the side of the carrier film 11 opposite the connection strands 12, 13, which is applied to the carrier film 11 in the same manner as the connection strands 12,13, and can consist of the same material as the connection strands 12, 13.

The structure shown in Fig. 5 of opposing connection strands 12, 13 separated from each other by an insulating intermediate layer in the form of the carrier layer 11 on the one hand and the counter strand 27 on the other yields an electric capacitor arrangement whose circuit diagram is shown in Fig. 6. According to Fig. 6, the structure of the substrate 28 yields an electrical serial connection of two capacitors arranged parallel to the chip 14.

Fig. 7 shows a possible variant for manufacturing a chip module, wherein the system design shown in Fig. 7 enables in particular the manufacture of the chip module 20 shown in Fig. 4 in a continuous and interconnected arrangement. To this end, the system diagrammatically shown in Fig. 7 encompasses a supply roll 30 with carrier film 11 wound onto it, which is unrolled in the direction of arrow 31, and wound up at the end of the system on a product roll 32. Located in the area between the supply roll 30 and product roll 32 are two supply rolls 33 and 34 with wound up connection strand 12 or 13. Located between the supply rolls 33 and 34 on the one hand and the product roll 32 on the other is a laminating roller 35. To manufacture a continuous, band-shaped and interconnected arrangement of chip carriers 28 or chip modules 20, as shown in Fig. 4, the carrier film 11 is clocked and advanced in the direction of the arrow 31 according to Fig. 7, wherein window openings are incorporated into the carrier film 11 at the prescribed clock rate at defined intervals via a stamping device 36 to form the contact receptacles 23, 24 shown in Fig. 4. Downstream of the stamping device 36, the connection strands 12, 13 are supplied to the carrier film 11 from the supply rolls 33, 34, and then connected with the carrier film 11 in a roll slit formed by the laminating roll 35 and a counter-roll 37 in a contact area 38. As a result of this joining or connecting process, the chip carrier 28 shown in cross section in Fig. 4 is therefore generated in continuous form downstream of the laminating roll 35, and wound on the product roll 32. The product roll 32

can now be used as a supply roll for a subsequent manufacturing process for the continuous or clocked contacting of chips 14 with the connection strands 12, 13, thus making it possible to manufacture continuously interconnected chip modules 20 as shown in Fig. 4.

To prepare for a subsequent manufacture of transponder units, coil units can also be contacted with the connection strands after the laminating process. The coils can here be designed as desired. The coils can be arranged on a separate carrier, or have no carrier in a particularly advantageous variant, being applied directly to the carrier film and contacted with the connection strands. In this connection, the use of wire coils proves advantageous.

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CLAIMS

1. A chip carrier for forming a chip module with a substrate and connection leads arranged on the substrate, wherein the connection leads are designed like stripes and extend parallel over the substrate,
characterized in that
the connection leads consist of electrically conductive connection strands (12, 13) applied to the substrate, and the substrate is formed by a carrier film (11).

2. The chip carrier according to claim 1,
characterized in that
the carrier film (11) is provided with at least one additional conductive counter-strand (27) on its side opposite the connection strands (12, 13) to generate a capacity, wherein the insulating carrier film is arranged as an intermediate layer between the connection strands on the one hand and the counter-strand on the other.

3. The chip carrier according to claim 1 or 2,
characterized by the fact that
the connection strands (12, 13) are at least sectionally provided with a connecting material coating for contacting with the contact metallizations (15, 16) of a chip (14).

4. The chip carrier according to one of the preceding claims,
characterized in that
the connection strands (12, 13) are at least sectionally provided with a contact metallization for contacting with the contact metallizations (15, 16) of a chip (14).

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5. The chip carrier according to one of the preceding claims, characterized in that
the connection strands (12, 13) are connected with the terminals of a coil unit.

6. The chip module with a chip carrier according to one of claims 1 to 5 and a chip having connecting surfaces with elevated contact metallizations,
characterized in that
the contact metallizations (15, 16) of the chip (14) are contacted with the top side (21) of the connection strands (12, 13).

7. The chip module according to claim 6,
characterized in that
the connection strands (12, 13) contacted with the contact metallizations (15, 16) of the chip (14) are connected with the terminals of the coil unit.

8. A method of manufacturing a chip module according to claim 6 or 7,
characterized by the following steps:

- applying at least two electrically conductive connection strands (12, 13) to one side of the carrier film (11), so that the connection strands extend parallel over the carrier surface, and
- contacting contact metallizations (15, 16) of the chip (14) with the connection strands, so that a contact metallization of the chip is contacted with a respective connection strand.

9. The method of manufacturing a chip module according to claim 8,

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characterized in that,
before contacting the connection strands (12, 13) with the chip (14), the connection strands are contacted with the coil unit.

10. The method of manufacturing a chip module according to claim 8 or 9,
characterized in that
the connection strands (12, 13) are continuously applied to the carrier film (11), in such a way that the connection strands and carrier film are prepared as continuous strands, and moved against each other continuously in a contact area (38) while forming an adhesion.

11. The method according to claim 10,
characterized in that
the carrier film is provided with window openings at defined distances before forming the contact area (38) with the connection strands (12, 13), so that the window openings in the subsequently formed contact area are covered by the connection strands (12, 13) while forming pocket-like contact receptacles (23, 24).

12. The method according to one of claims 8 to 11,
characterized in that
the carrier film (11) is coated with at least one additional electrically conductive counter-strand (27) on the side opposite the side intended for applying the connection strands (12, 13).

13. The method according to one of claims 8 to 12,
characterized in that

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the connection strands (12, 13) and/or the at least one counter-strand (27) are applied to the carrier film (11) in a laminating process.

14. The method according to claim 13,
characterized in that
the adhesion between the connection strands (12, 13) and/or at least one counter-strand (27) and carrier film (11) is generated via a hot-melt application.

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