

SIM CARD CONNECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a SIM card connector, and more particularly, to a SIM card connector comprising an insulating housing insert molded with a plurality of terminals.

2. Description of the Related Art

As the electronic and information technology advances, SIM card connectors are popularly applied. However, as consumer demand for electronic devices of compact size continues to grow, electronic devices, especially portable devices such as mobile phones, are becoming increasingly lighter and thinner. To meet such demand, the SIM card connector has to decrease in size accordingly. One common way to reduce size is to insert a molded insulating body with terminals of a SIM card connector, which allows for a thinner SIM card connector because the insulating body does not need extra space for installing the terminals.

Referring to FIGS. 1 and 2, Chinese Patent Publication Number CN201160170Y discloses a SIM card connector 8. The SIM card connector 8 includes an insulation body 81 and plural conductive terminals 82. The insulation body 81 is formed with plural terminal slots 83. The conductive terminal 82 includes a contact portion 821, a connecting portion 822, and a fixing portion 823, wherein the contact portion 821 and the fixing portion 823 extend in a direction opposite from the connecting portion 822. The insulation body 81 is insert-molded with the plural conductive terminals 82. After insert-molding, the contact portion 821 extends in the corresponding terminal slot 83 and protrudes from the upper surface of the insulation body 81; the connecting portion 822 extends in the insulation body 81; and the fixing portion 823 is bent and extends along the same plane as the insulation body 81.

After a SIM card is inserted, the contact portion 821 is pushed down and elastically deforms, and simultaneously, the connecting portion 822 exerts force on the insulation body 81 around the connecting portion 822. To sustain the force from the connecting portion 822, the insulation body 81 must have sufficient strength, and additionally, the securing force of the insulation body 81 to the connecting portion 822 must also be sufficient so that the conductive terminal 82 can be firmly secured after it is pushed down by the SIM card. Because the connecting portion 822 of the conductive terminal 82 has a planar shape, and to sustain the force from the connecting portion 822 and to provide sufficient securing force of the insulation body 81 to the connecting portion 822, the insulation body 81 must be thick and insert molded around the connecting portion 822. The need to wrap the connecting portion 822 by a thick insulation body 81 may inhibit progress in the miniaturization of the SIM card connector.

Based on the above, although extensive research has been applied and improvements have been made to the SIM card connector, further developments are required to overcome the above-mentioned drawbacks.

SUMMARY OF THE INVENTION

An objective of the present invention is to provide a SIM card connector that comprises an insulating body insert molded with a plurality of terminals, achieving high stability for positioning the terminals within the insulating body while maintaining a small size of the SIM card connector.

In order to achieve the above objective, a SIM card connector is provided, comprising: an insulating body defining a top surface, a bottom surface, and a plurality of passageways; a plurality of terminals formed integrally with the insulating body by insert molding, each terminal comprising a spring arm inclined upward into the corresponding passageway; a contact portion formed in one end of the spring arm; a fixing portion connecting with the spring arm; and a solder portion connecting the fixing portion. The fixing portion comprises a first fixing portion disposed adjacent to the bottom surface of the

insulating body and a second fixing portion connecting with the first fixing portion, wherein the second fixing portion includes a plate-like section disposed adjacent to the top surface of the insulating body and extending in a direction approximately parallel to the major surfaces of the insulating body.

One embodiment of the present invention provides a SIM card, which comprises the first fixing portion shaped into a plate and having an opening in the middle thereof, and the second fixing portion crookedly bridging the opening. In another embodiment, the second fixing portion is in the shape of two wings inclined upward from two opposite sides of the first fixing portion, wherein the free end of each wing is flat or curved. The spring arm and the soldering portion respectively extend from two different ends of the first fixing portion at an obtuse angle. The free end of the soldering portion extends outside of the insulating body, and is shaped into an enlarged portion to increase the soldering area thereof for contacting a PCB. Furthermore, the bottom of the first fixing portion, the bottom of the soldering portion, and the bottom of the insulating body are on the same plane. The top surface of the second fixing portion is exposed and not hidden by the top surface of the insulating body.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described according to the appended drawings in which:

FIG. 1 shows a prior SIM card connector;

FIG. 2 is a perspective view showing the prior SIM card connector of FIG. 1;

FIG. 3 is a top perspective view of a SIM card connector showing an insulating body being assembled into a metal frame according to one embodiment of the present invention;

FIG. 4 is a perspective view of a SIM card connector viewed from the

bottom according to one embodiment of the present invention;

FIGS. 5 and 6 are schematic views showing an arrangement of a metal frame, a molded insulating body, a plurality of terminals, and a plurality of engaging elements according to one embodiment of the present invention;

FIG. 7 is a perspective view in partial cutaway of an insulating body along a direction parallel to a terminal's lengthwise direction, and shows the integration of the fixing portion of the terminal and the insulating body and the integration of an engaging element and the insulating body according to one embodiment of the present invention;

FIG. 8 is a perspective view in partial cutaway of an insulating body along a direction parallel to a terminal's widthwise direction, and shows the integration of the fixing portion of the terminal and the insulating body according to one embodiment of the present invention;

FIG. 9 is a perspective view of a SIM card connector mounted on a PCB according to one embodiment of the present invention;

FIG. 10 is a perspective view of an insulating body integrated with a plurality of terminals and a plurality of engaging elements according to another embodiment of the present invention;

FIG. 11 is a perspective view of the terminal of the SIM card connector of FIG. 10;

FIG. 12 a perspective view in partial cutaway of an insulating body along a direction perpendicular to the inserting direction A, and shows the integration of the fixing portion of the terminal and the insulating body of the SIM card connector of FIG. 11;

FIG. 13 is a perspective view in partial cutaway of an insulating body along a direction parallel to a terminal's lengthwise direction, and shows the integration of the fixing portion of the terminal and the insulating body and the integration of an engaging element and the insulating body according to another

embodiment of the present invention; and

FIG. 14 is a perspective view in partial cutaway of an insulating body along a direction perpendicular to the inserting direction A, and shows the integration of the fixing portion of the terminal and the insulating body according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, embodiments of the present invention are described in detail with reference to the attached drawings.

The present invention provides a SIM card connector comprising an insulating body and a plurality of terminals. Each terminal includes a fixing portion having a first fixing portion and a second fixing portion. The fixing portion is insert-molded in the insulating body with the first fixing portion disposed adjacent to the bottom surface of the insulating body. The second fixing portion connects with the first fixing portion, and includes a plate-like section disposed adjacent to the top surface of the insulating body and extending in a direction approximately parallel to the major surfaces of the insulating body. The first fixing portion may emerge at the bottom surface of the insulating body, and the second fixing portion may emerge at the top surface of the insulating body. The above-mentioned features allow the thickness of the insulating body of such a SIM card connector to be further reduced, while retaining the ability to securely hold the terminals.

As shown in FIGS. 3 and 9, the SIM card connector 1 comprises an insulating body 2, a plurality of terminals 3 formed integrally with the insulating body 2 by insert molding, and a metal frame 4 including two side plates 41 and a top plate 40 connecting the two side plates 41. As shown in FIG. 9, the metal frame 4 and the insulating body 2 define a card-insertion space 10 configured to allow a SIM card to be inserted in the direction indicated by arrow A to electrically engage the plurality of terminals 3.

FIG. 4 shows a perspective view of a SIM card connector 1 according to one embodiment of the present invention. FIGS. 5 and 6 are schematic views

showing an arrangement of a metal frame 4, a molded insulating body 2, a plurality of terminals 3, and a plurality of engaging elements 5 according to one embodiment of the present invention. FIG. 7 is a perspective view in partial cutaway of an insulating body 2 along a direction parallel to a terminal's lengthwise direction, showing the integration of the fixing portion 32 of the terminal 3 and the insulating body 2 and the integration of an engaging element 5 and the insulating body 2, according to one embodiment of the present invention. FIG. 8 is a perspective view in partial cutaway of an insulating body 2 along a direction parallel to a terminal's widthwise direction, showing of the integration of the fixing portion 32 of the terminal 3 and the insulating body 2, according to one embodiment of the present invention.

As shown in FIGS. 4 to 8, the insulating body 2 can be rectangularly shaped and comprises a top surface 20, a bottom surface 21 opposite to the top surface 20, and a plurality of passageways 22 extending through the insulating body 2 from the top surface 20 to the bottom surface 21. In this embodiment, the plurality of passageways 22 are arranged in two rows along the inserting direction A of a SIM card. An open slot 23 is formed between the two rows of passageways 22 and extends from the top surface 20 through to the bottom surface 21.

Each terminal 3 comprises a spring arm 30, a contact portion 31, a fixing portion 32, and a soldering portion 33. The spring arm 30 extends upward into a corresponding one of the plurality of passageways 22. A contact portion 31 is further formed in one end of the spring arm 30, and protrudes into the card-insertion space 10. The fixing portion 32 extends from the other end of the spring arm 30, and is insert molded in the insulating body 2. Furthermore, the fixing portion 32 comprises a first fixing portion 320 near the bottom surface 21 of the insulating body 2, and a second fixing portion 321 near the top surface 20 the insulating body 2 and connecting with the first fixing portion 320. The first fixing portion 320, the insulating material layer 25 of the insulating body 2, and the second fixing portion 321 are arranged in cross sections across the insulating body 2 where the first fixing portion 320 and the second fixing portion 321 are located. The soldering portion 33

extends from one end of the fixing portion 32 at an obtuse angle with respect to the spring arm 30 so that the length of the spring arm 30 can be increased without causing any interference and the elasticity of the spring arm 30 can be improved. The ends of the soldering portions 33 in the front row along the inserting direction A extend to the outside of the insulating body 2, while the ends of the soldering portions 33 in the back row are disposed in the open slot 23 of the insulating body 2. In the present embodiment, in order to securely solder the terminals 3 on a printed circuit board PCB 6 (see FIG. 4), the end of the soldering portion 33 is configured with an enlarged portion 330 so as to increase the soldering area thereof for contacting the PCB 6.

In the present embodiment, the fixing portion 32 comprises a first fixing portion 320 that is flat and has an opening 322 in its middle, wherein the fixing portion 32 further comprises a second fixing portion 321 including a plate-like section 324 and the second fixing portion 321 crookedly bridges over the opening 322. The plate-like section 324 of the second fixing portion 321 is disposed above the opening 322, is adjacent to the top surface of the insulating body, and extends in a direction approximately parallel to the major surfaces of the insulating body 2. As shown in FIG. 7, the plate-like section 324 is disposed adjacent to the top surface 20 of the insulating body 2, and extends in a direction approximately parallel to the major surfaces of the insulating body 2 so that a top surface of the plate-like section 324 may face upward. The top surface of the plate-like section 324 can be curved or flat, and the top surface of the plate-like section 324 may or may not emerge at the top surface 20 of the insulating body 2 as shown in FIG. 7. In one embodiment, the top surface of the plate-like section 324 may be flat and flush with the top surface 20 of the insulating body 2. In addition, the bridging second fixing portion 321 can have an arc shape as shown in FIG. 7, or can have a trapezoid shape as shown in FIG. 13.

The spring arm 30 and the soldering portion 33 respectively extend from two different ends of the first fixing portion 320 at an obtuse angle. The insulating material, such as plastic, can flow into the opening 322 during insert molding of the plurality of terminals 3 to the insulating body 2. As shown in

FIGS. 7 and 8, the first fixing portion 320, the insulating material layer 25 of the insulating body 2, and the second fixing portion 321 are arranged in sections across the insulating body 2 where the first fixing portion 320 and the second fixing portion 321 are located. FIG. 7 is a perspective view in partial cutaway of an insulating body 2 along a direction parallel to a terminal's lengthwise direction, showing the integration of the fixing portion 32 of the terminal 3 and the insulating body 2 and the integration of an engaging element 5 and the insulating body 2. FIG. 8 is a perspective view in partial cutaway of an insulating body 2 along a direction parallel to a terminal's widthwise direction, showing of the integration of the fixing portion 32 of the terminal 3 and the insulating body 2. It can be seen that, in each section along the first fixing portion 320 and the second fixing portion 321, a part 250 of the insulating material layer 25 is on the bottom of the second fixing portion 321, and another part 251 of the insulating material layer 25 is on the top of the first fixing portion 320. Thus, the terminal 3 can have a larger contact area with the insulating body 2 than a prior terminal in a limited vertical space, thereby creating a greater securing force between the insulating body 2 and the terminal 3.

The bottom surface of the first fixing portion 320 of each terminal 3 may emerge at the bottom surface 21, yet does not need to be flush with the bottom surface 21. However, in order to make the insulating body 2 as thin as possible, the first fixing portion 320 preferably can be flush mounted; namely, the bottom surface of the first fixing portion 320 can emerge at the bottom surface 21 of the insulating body 2. Furthermore, the top surface of the second fixing portion 321 can emerge at the top surface 20 of the insulating body 2 as well. In addition, the bottom surface of the first fixing portion 320, the bottom surface of the soldering portion 33, and the bottom surface of the insulating body 2 can be on the same plane so as to further reduce the thickness of the insulating body 2.

In particular, the bottom surface of the first fixing portion 320 emerges from the bottom surface 21 and is substantially flush with the bottom surface 21 of the insulating body 2. In addition, the opening 322 may be defined by two

opposite side surfaces, to which the second fixing portion 321 separately connect, and the second fixing portion 321 may crookedly bridge over the opening 322 so that after insert molding, a portion of the insulating body 2 can be formed in the opening 322 and below the second fixing portion 321 such that the insulating body 2 and the second fixing portion 321 are engaged in a mutually hooked manner, resulting in stronger engagement between the insulating body 2 and the second fixing portion 321. The crookedly bridging second fixing portion 321 may have an arc shape, which can be bowed upward if the first fixing portion 32 is disposed adjacent to the bottom surface 21 of the insulating body 2, or bowed downward if the first fixing portion 32 is disposed adjacent to the top surface 20 of the insulating body 2.

The metal frame 4 comprises a top plate 40 and two side plates 41 extending from two ends of the top plate 40. Close to each end of each side plate 41, at least one soldering slice 410 extends from the edge of the side plate 41 and toward the insulating body 2. In the present embodiment, the at least one soldering slice 410 includes a pair of soldering slices 410. Corresponding to each pair of soldering slices 410, the SIM card connector 1 further comprises four engaging elements 5 insert molded at the four corners of the insulating body 2. That is, each corner of the insulating body 2 is provided with an engaging element 5. Each engaging element 5 defines a securing slice 50 corresponding to each pair of soldering slice 410 in each end of the side plates 41. Referring to FIG. 9, the PCB 6 is provided with a plurality of solder pads 60 corresponding to the soldering portions 33 of the terminals 3 and the soldering slices 410 of the solder plates 41. After the SIM card connector 1 is soldered to the PCB 6, each securing slice 50 and its corresponding soldering slice 410 can be soldered on the same solder pad 60. Consequently, the insulating body 2 can be prevented from warping which could otherwise be caused by the extremely thin profile of the insulating body 2 during the soldering process.

The SIM card connector 1 of the present invention has various embodiments. Referring to FIGS. 10 to 12, another embodiment of the SIM card connector 1 is illustrated, wherein the fixing portion 32 of each terminal 3

is different from the above embodiment but belongs to the same general invention concept. The fixing portion 32 comprises a first fixing portion 320 shaped into a plate and a second fixing portion 321, wherein the first fixing portion 320 is nearer the bottom surface 21 of the insulating body 2 than the second fixing portion 321, and the second fixing portion 321 is nearer the top surface 20 of the insulating body 2. The spring arm 30 and the soldering portion 33 respectively extend from two different ends of the first fixing portion 320 at an obtuse angle. The second fixing portion 321 may include two wings 323 extending respectively from two opposite sides of the first fixing portion 320. As shown in FIG. 11, each wing 323 includes a distal plate-like section 324', and each wing 323 extends crookedly upward and then extends alongside the top surface 20 to form the plate-like section 324' disposed adjacent to the top surface 20 of the insulating body 2 and extending in a direction approximately parallel to the major surfaces of the insulating body 2 as shown in FIG. 12. The first fixing portion 320, the insulating material layer 25 of the insulating body 2, and the second fixing portion 321 are arranged in cross sections across the insulating body 2 where the first fixing portion 320 and the second fixing portion 321 are located. That is, a part 252 of the insulating material layer 25 is on the top of the first fixing portion 320, and another part 253 of the insulating material layer 25 is on the bottom of the second fixing portion 321. The free end of the soldering portion 33 can be shaped into an enlarged portion 330 to increase the soldering area thereof for contacting the PCB 6. Thus, each terminal 3 can have a larger contact area engaging the insulating body 2 than a prior art terminal, thereby strengthening the securing force of the insulating body 2 to the terminal 3.

As shown in FIGS. 12 and 14, the plate-like section 324' may have a top surface that can either emerge at the top surface 20 or be hidden by the top surface 20, and the top surface of the plate-like section 324' can be either flat as shown in FIG. 12 or curved as shown in FIG. 14. As mentioned above, to make the insulating body 2 as thin as possible, the bottom surface of the first fixing portion 320 is preferably exposed and not hidden by the bottom surface 21 of insulating body 2. In particular, the bottom surface of the first fixing

portion 320, the bottom surface of the soldering portion 33, and the bottom surface of the insulating body 2 can be on the same plane. The top surface of the plate-like section 324', can be exposed and not hidden by the top surface 20 of the insulating body 2.

The above embodiments are illustrated in order to facilitate understanding of the present invention, and shall not be deemed as limitations to the present invention. Persons skilled in the art can obtain numerous embodiments besides the above without creative work under the teaching and suggestion of the present invention, for example, as an alternation of the first embodiment, the second fixing portion 321 may include an opening 322 in the middle thereof; and the first fixing portion 320 may bridge the opening 322 with a shape of downward arc having a top surface that can be flat or curved. The spring arm 30 and the soldering portion 33 respectively extend from two different ends of the second fixing portion 321 at an obtuse angle. Similarly, as an alternative form of the second embodiment, the fixing portion 32 may comprise a first fixing portion 320 and a flat second fixing portion 321; the spring arm 30 and the soldering portion 33 may respectively extend from two different ends of the second fixing portion 321 at an obtuse angle; the first fixing portion 320 may include two wings 323 extending upward from opposite sides of the second fixing portion 321, and the free end of each wing 323 can be flat. In another embodiment, the first fixing portion 320 may include only one wing 323.

Compared with prior SIM card connectors, according to the present invention, the fixing portion 32 of the terminal 3 includes a first fixing portion 320 and a second fixing portion 321, wherein the first fixing portion 320 is nearer the bottom surface 21 than the second fixing portion 321, and the second fixing portion 321 is nearer the top surface 20 than the first fixing portion 320; and the first fixing portion 320, the insulating material layer 25 of the insulating body 2, and the second fixing portion 321 are arranged in cross sections across the insulating body 2 where the first fixing portion 320 and the second fixing portion 321 are located. Therefore, the present invention has the advantages of small size and high stability.

In summary, the terminal of the present invention, insert molded into an insulating body, includes a fixing portion that is partially exposed from the top surface and the bottom of the insulating body, namely, the fixing portion is not completely wrapped by a thick insulating body. Therefore, the thickness of the insulating body can be further reduced; as a result, the thickness of the SIM card connector can be further reduced. Most of the fixing portion is wrapped by the insulating body so that the terminal can have a large contact area with the insulating body, creating a greater securing force between the insulating body and the terminal. Due to the greater securing force between the insulating body and the terminal, the security of the terminal is not diminished even though the thickness of the insulating body is reduced to expose a portion of the fixing portion.

The above-described embodiments of the present invention are intended to be illustrative only. Numerous alternative embodiments may be devised by persons skilled in the art without departing from the scope of the following claims.

What is claimed is:

1. A SIM card connector, comprising:

an insulating body defining a top surface, a bottom surface, and a plurality of passageways extending through the insulating body, from the top surface to the bottom surface;

a plurality of terminals formed integrally with the insulating body by insert molding; each of the plurality of terminals comprising:

a spring arm extending upward into the corresponding one of the plurality of passageways;

a contact portion formed in one end of the spring arm;

a fixing portion connecting with the spring arm, the fixing portion comprising:

a first fixing portion having a bottom surface and disposed adjacent to the bottom surface of the insulating body; and

a second fixing portion connecting with the first fixing portion, the second fixing portion including a plate-like section having a top surface, the plate-like section disposed adjacent to the top surface of the insulating body and extending in a direction approximately parallel to the major surfaces of the insulating body; and

a solder portion connecting with the fixing portion.

2. The SIM card connector of Claim 1, wherein the top surface of the plate-like section emerges from the top surface of the insulating body.

3. The SIM card connector of Claim 2, wherein the bottom surface of the first fixing portion emerges from the bottom surface of the insulating body.

4. The SIM card connector of Claim 1, wherein the bottom surface of

the first fixing portion emerges from the bottom surface of the insulating body.

5. The SIM card connector of any one of Claims 1 to 4, wherein the first fixing portion is flat and has an opening in its middle, the second fixing portion includes the plate-like section, and the second fixing portion crookedly bridges over the opening with the plate-like section disposed above the opening, wherein the top surface of the plate-like section is curved or flat.

6. The SIM card connector of Claim 5, wherein the first fixing portion is flush mounted on the bottom surface of the insulating body.

7. The SIM card connector of Claim 6, wherein the top surface of the plate-like section is flat, and the top surface of the plate-like section is flush with the top surface of the insulating body.

8. The SIM card connector of Claim 7, wherein a bottom surface of the solder portion is flush with the bottom surface of the first fixing portion.

9. The SIM card connector of Claim 8, wherein the free end of the soldering portion extends outside of the insulating body.

10. The SIM card connector of Claim 9, wherein the bottom surface of the first fixing portion, the bottom surface of the soldering portion, and the bottom surface of the insulating body are on the same plane.

11. The SIM card connector of Claim 10, wherein the free end of the soldering portion is shaped into an enlarged portion to increase a soldering area.

12. The SIM card connector of Claim 11, wherein the spring arm and the soldering portion respectively extend from two different ends of the first fixing portion at an obtuse angle.

13. The SIM card connector of any one of Claims 1 to 4, wherein the first fixing portion is shaped into a plate, the second fixing portion includes two wings extending respectively from opposite sides of the first fixing portion, and the wing extends alongside the top surface of the insulating body to form the

plate-like section.

14. The SIM card connector of Claim 13, wherein the top surface of the plate-like section of the wing is flat or curved.

15. The SIM card connector of Claim 14, wherein the first fixing portion is flush mounted on the bottom surface of the insulating body.

16. The SIM card connector of Claim 15, wherein the top surface of the plate-like section of the wing is flat, and the top surface of the plate-like section of the wing is flush with the top surface of the insulating body.

17. The SIM card connector of Claim 16, wherein a bottom surface of the solder portion is flush with the bottom surface of the first fixing portion.

18. The SIM card connector of Claim 17, wherein the free end of the soldering portion extends outside of the insulating body.

19. The SIM card connector of Claim 18, wherein the bottom surface of the first fixing portion, the bottom surface of the soldering portion, and the bottom surface of the insulating body are on the same plane.

20. The SIM card connector of Claim 19, wherein the free end of the soldering portion is shaped into an enlarged portion to increase a soldering area.

21. The SIM card connector of Claim 20, wherein the spring arm and the soldering portion respectively extend from two different ends of the first fixing portion at an obtuse angle.