

ELECTRICAL CARD CONNECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an electrical card connector.

2. Description of the Related Art

Electronic devices may be furnished with connectors for connecting electrical cards or mating connectors. The connectors in the electronic devices are usually designed to protect electrical cards or mating connectors against improper insertion. For example, a traditional card connector 100 as shown in FIG. 1 includes a cover 101 mounted on a base 102, having an anti-disorientation means 103 extending from the top of the cover 101 downward into an electrical card receiving space for preventing improper insertion of an electrical card.

As shown in FIG. 2, the anti-disorientation means 103 is formed similarly to a cantilever. The anti-disorientation means 103 extends downward and forward so that its leading edge 1033 can meet the front edge of an incorrectly inserted electrical card 104. The anti-disorientation means 103 is further adapted to be oblique to one lateral side. Specifically, the anti-disorientation means 103 has two lateral sides 1031 and 1032, in which the lateral side 1031 is higher than the lateral side 1032. In addition, the lateral side 1031 is configured to be shorter than the lateral side 1032. With the above structural features, the upper edge of the cut corner 1041 can push the anti-disorientation means 103 upward during the insertion of a correctly inserted electrical card 104 so that the anti-disorientation means 103 does not impede the insertion of the electrical card 104. In contrast, a right-angled corner of an improperly inserted electrical card 104 may be blocked by the leading edge 1033 of the anti-disorientation means 103, preventing the insertion of the electrical card 104.

The leading edge 1033 of the anti-disorientation means 103 is freely movable and not supported so that the leading edge 1033 may be shifted from its designated position due to manufacturing errors or the deformation of the anti-disorientation means 103 caused by force applied during manufacturing processes or generated during engagement with an inserted electrical card. As a result, if the leading edge 1033 is shifted too high, the anti-disorientation means 103 may fail to prevent the insertion of an improperly inserted electrical card 104. Alternatively, if the leading edge 1033 is shifted too low, the anti-disorientation means 103 may prevent the insertion of a correctly inserted electrical card 104.

Furthermore, the anti-disorientation means 103 is formed to be oblique to one lateral side with its two lateral sides having different lengths. To manufacture an anti-disorientation means 103 with such delicate features, complex tools and processes are required, leading to increased manufacturing cost and time.

Moreover, a cantilevered anti-disorientation means 103 can be easily deformed or bent when a large force is applied to try to insert an improperly inserted electrical card engaging its leading edge 1033. Once the anti-disorientation means 103 is deformed, the anti-disorientation means 103 may not stop the next improper insertion of an electrical card 104.

SUMMARY OF THE INVENTION

One objective of the present invention is to provide an electrical card connector having means that can prevent the incorrect insertion of an electrical card and that can be easily manufactured.

Another objective of the present invention is to provide an electrical card connector having means that can prevent the incorrect insertion of an electrical card and that can be manufactured with low cost and fewer process steps.

Another objective of the present invention is to provide an electrical

card connector having means that can prevent the incorrect insertion of an electrical card and that is not easily deformed.

Another objective of the present invention is to provide an electrical card connector having means that can prevent the incorrect insertion of an electrical card and that can be manufactured consistently.

In order to achieve the above objectives, one embodiment of the present invention discloses an electrical card connector configured to receive an electrical card including an insertion end and a cut corner formed on the insertion end. The electrical card connector may comprise an insulating housing, a plurality of terminals, and a metal shell. The plurality of terminals are attached to the insulating housing. The metal shell can be associated with the insulating housing to form a first space wall surface, a second space wall surface, a card-receiving space, and an opening, wherein the first space wall surface and the second space wall surface define the card-receiving space. The opening can be communicated with the card-receiving space. The insertion end of the electrical card can be inserted into the card-receiving space through the opening. The metal shell can comprise a top plate member and an elastic strip element. The elastic strip element may comprise a first end attached to the top plate member and a second end opposite the first end. The elastic strip element can extend from the top plate member downward with the second end serving as a free end. The elastic strip element can extend in a direction from the first space wall surface toward the second space wall surface. The distance between the first end and the first space wall surface can be greater than the width of the insertion end of the electrical card.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 is a view showing a traditional card connector;

FIG. 2 shows the anti-disorientation means of the card connector of FIG. 1;

FIG. 3 is a perspective view showing an electrical card connector according to one embodiment of the present invention;

5 FIG. 4 is a perspective, exploded view showing an electrical card connector according to one embodiment of the present invention;

FIG. 5 is a perspective view showing an electrical card inserted in an electrical card connector according to one embodiment of the present invention;

10 FIG. 6 is a view demonstrating an electrical card being inserted into a metal shell according to one embodiment of the present invention;

FIG. 7 is a plane view showing an incorrectly inserted electrical card impeded by the elastic strip element attached to a metal shell according to one embodiment of the present invention;

15 FIG. 8 is a perspective view showing an incorrectly inserted electrical card impeded by the elastic strip element attached to a metal shell according to one embodiment of the present invention;

FIG. 9 is a perspective view showing an electrical card connector configured to receive a mini SIM card and installed in an electronic device
20 according one embodiment of the present invention;

FIG. 10 is a perspective view showing an electrical card connector according to another embodiment of the present invention;

FIG. 11 is a perspective, exploded view showing an electrical card connector according to another embodiment of the present invention;

25 FIG. 12 is a perspective view showing an electrical card connector according to another embodiment of the present invention;

FIG. 13 is a perspective, exploded view showing an electrical card connector according to another embodiment of the present invention; and

FIG. 14 demonstrates an electrical card inserted in an electrical card connector according to one embodiment of the present invention.

5 **DETAILED DESCRIPTION OF THE INVENTION**

FIG. 3 is a perspective view showing an electrical card connector 1 according to one embodiment of the present invention. FIG. 4 is a perspective, exploded view showing an electrical card connector 1 according to one embodiment of the present invention. FIG. 5 is a perspective view showing an electrical card 2 inserted in an electrical card connector 1 according to one embodiment of the present invention. FIG. 6 is a view demonstrating an electrical card 2 being inserted into a metal shell 13 according to one embodiment of the present invention. Referring to FIGS. 3, 4 and 6, the electrical card connector 1 comprises an insulating housing 11, a plurality of terminals 12 attached to the insulating housing 11, and a metal shell 13 mountable to the insulating housing 11. The plurality of terminals 12 can be insert-molded with the insulating housing 11. As shown in FIG. 3, the metal shell 13 is associated with the insulating housing 11 to form a first space wall surface 14, a second space wall surface 15, a card-receiving space 16, and an opening 17. The card-receiving space 16 can be configured to receive or partially receive an electrical card 2. The first space wall surface 14 and the second space wall surface 15 partially define the card-receiving space 16, and can be opposite each other. The opening 17 can be connected to the card-receiving space 16. An electrical card 2 can be inserted into the card-receiving space 16 through the opening 17.

As shown in FIGS. 3 and 6, the electrical card connector 1 can be configured to receive an electrical card 2 including an insertion end 21 and a cut corner 22 as shown in FIG. 6. The insertion end 21 is the leading end that is first inserted during the insertion of the electrical card 2. The cut

corner 22 is formed on the insertion end 21.

Referring back to FIGS. 3 and 4, the metal shell 13 may comprise a top plate member 131 extending over the card-receiving space 16 and an elastic strip element 132 attached to the top plate member 131. As shown in FIGS 3 and 6, the elastic strip element 132 extends from the top plate member 131 of the metal shell 13, and may comprise a first end 1321 connecting to the top plate member 131 and a second end 1322 opposite to the first end 1321. The second end 1322 is in the card-receiving space 16 and serves as a free end. The elastic strip element 132 may extend in a direction from the first space wall surface 14 toward the second space wall surface 15 as shown in FIG. 3. The elastic strip element 132 extends downward and toward a side of the electrical card connector 1 so that it can be easily manufactured, and a stamping tool in use can be slightly modified to manufacture new shells with such a feature.

In one embodiment, the elastic strip element 132 can be formed by stamping and bending a portion of the metal shell 13.

In one embodiment, the elastic strip element 132 can be a straight strip element.

Further, the elastic strip element 132 is configured to allow the insertion of a correctly inserted electrical card 2 while stopping the insertion of an incorrectly inserted electrical card 2. To this end, as shown in FIGS. 3 and 6, the distance W_2 between the first end 1321 and the first space wall surface 14 is configured to be greater than the width W_1 of the insertion end 21. As such, the insertion end 21 does not engage the elastic strip element 132 during the insertion of the electrical card 2, and the elastic strip element 132 can be easily and gradually moved upward to allow the electrical card 2 to be moved in as the contact point between an edge of the cut corner 22 of the electrical card 2 and the elastic strip element 132 moves along the elastic strip element 132.

Referring FIGS. 3, 7 and 8, as an electrical card 2 is incorrectly inserted, a rear end opposite to the insertion end 21 where the cut corner 22 is formed may engage a side 1323 of the elastic strip element 132 facing the opening 17 of the electrical card connector 1 during the insertion of the electrical card 2 so that the movement of the electrical card 2 is impeded, and the electrical card 2 is prevented from being inserted.

The elastic strip element 132 extends from the top plate member 131 of the metal shell 13 so that the top plate member 131 provides a basis for positioning the elastic strip element 132. Moreover, because the metal shell 13 can be precisely manufactured, the position of the elastic strip element 132 or the side of the elastic strip element 132 engageable with the incorrectly inserted electrical card 2 can be manufactured consistently. Thus, the problem of manufacturing electrical card connectors that cannot prevent electrical cards from being improperly inserted due to manufacturing errors can be avoided.

In addition, as shown in FIG. 7, one end of the side 1323 extends adjacent to the top plate member 131 of the metal shell 13 so that the position of that end is fixed and will not be changed easily when the elastic strip element 132 is subjected to a force. Thus, the shift of the position of the entire side 1323, causing the failure of the elastic strip element 132, cannot occur.

Furthermore, in comparison with those conventional connectors with means that impede the insertion of improperly inserted electrical card 2 by their distal ends, the elastic strip element 132 extending transversely to the insertion direction of an electrical card 2 with one lateral side engaging an improperly inserted electrical card 2 cannot be easily deformed when the elastic strip element 132 is subjected to large force applied to an improperly inserted electrical card 2, as a user attempts to use force to insert the electrical card 2.

FIG. 9 is a perspective view showing an electrical card connector 1

configured to receive a mini SIM card and installed in an electronic device according one embodiment of the present invention. In one embodiment, the present invention can be embodied as an electrical card connector that can receive a mini SIM card and includes a stopper provided to stop the
5 insertion of an electrical card by indicating the end of the insertion range. Such electrical card connector is large, due to the additional space required to receive an electrical card along with the ability to stop the insertion of the electrical card. In some circumstances, a smaller electrical card connector 1 that can receive a mini SIM card is required for a compact electronic device
10 such as a mobile phone or other portable electronic device. In order to reduce its size, the electrical card connector 1 is designed without a stopper, thus eliminating the special accommodation for a mini SIM card. Without any means of stopping the insertion of an electrical card, users cannot know whether the electrical card is properly inserted. To overcome such
15 deficiency and create a solution for stopping the insertion of an electrical card, the electrical card connector 1 may be placed near a wall or protrusion of the electronic device that can function as a stopper 3.

Referring to FIG. 4, the insulating housing 11 may comprise a first side wall 111 having an inner wall surface facing the card-receiving space 16
20 and a second side wall 112 having an inner wall surface facing the card-receiving space 16. In the embodiment of FIG. 4, the inner wall surface of the first side wall 111 serves as the first space wall surface 14, and the inner wall surface of the second side wall 112 serves as the second space wall surface 15. In another embodiment, the electrical card connector 1 may
25 include an insulating housing without the above-mentioned side walls, while the metal shell 13 may comprise two oppositely disposed side walls. Under such a circumstance, the inner surfaces of the side walls of the metal shell 13 separately serve as first and second space wall surfaces 14 and 15.

FIG. 10 is a perspective view showing an electrical card connector 1'
30 according to another embodiment of the present invention. FIG. 11 is a perspective, exploded view showing an electrical card connector 1'

according to another embodiment of the present invention. Referring to FIGS. 10 and 11, the electrical card connector 1' comprises an insulating housing 11, a plurality of terminals 12 attached to the insulating housing 11 and a metal shell 13' mountable on the insulating housing 11. The metal shell 13' may comprise a top plate member 131' and an elastic strip element 132' including a first end 1321 attached to the top plate member 131' and a distal second end 1322 opposite the first end 1321. The metal shell 13' further comprises at least one gap 133 formed on the top plate member 131' and along a side of the elastic strip element 132' such that the length of the elastic strip element 132' can be extended, and the elastic strip element 132' can be more flexible.

In the present embodiment, the top plate member 131' of the metal shell 13' includes two gaps 133. The elastic strip element 132' comprises a flat portion extending between the two gaps and an inclined portion extending from the flat portion downward and toward a side of the electrical card connector 1' for preventing the incorrect insertion of an electrical card 2.

FIG. 12 is a perspective view showing an electrical card connector 5 according to another embodiment of the present invention. FIG. 13 is a perspective, exploded view showing an electrical card connector 5 according to another embodiment of the present invention. Referring to FIGS. 12 and 13, the electrical card connector 5 comprises an insulating housing 51, a plurality of terminals 52 attached to the insulating housing 51, and a metal shell 53 mountable on the insulating housing 51. The metal shell 53 and the insulating housing 51 form in combination a first space wall surface 54, a second space wall surface 55, a card-receiving space 56, and an opening 57. The first space wall surface 54 and the second space wall surface 55 define the card-receiving space 56. The opening 57 connects to the card-receiving space 56.

FIG. 14 demonstrates an electrical card 6 inserted in an electrical card connector 5 according to one embodiment of the present invention.

Referring to FIGS. 12 to 14, an electrical card 6 can be inserted into the card-receiving space 56 through the opening 57 as shown in FIG. 14. The electrical card 6 may comprise an insertion end 61 and a cut corner 62 formed on the insertion end 61. Correspondingly, the electrical card connector 5 further comprises an elastic strip element 532 including a first end 5321 attached to the top plate member 531 of the metal shell 53 and a second end 5322 opposite the first end 5321. The second end 5322 can be a free end. The elastic strip element 532 can be formed by bending, in a downward direction, the portion stamped out of the metal shell 53. The elastic strip element 532 may extend in a direction from the first space wall surface 54 toward the second space wall surface 55. The elastic strip element 532 impedes the insertion of an electrical card 6 if a wrong end is inserted first. The elastic strip element 532 can be configured such that the insertion end 61 does not encounter the elastic strip element 532 and the cut corner 62 can gradually push the elastic strip element 532 upward so as to allow the electrical card 6 to be completely inserted.

In one embodiment, the elastic strip element 532 can be a straight strip element.

Referring to FIG. 13, the insulating housing 51 comprises a first side wall 511 and a second side wall 512. The inner wall surfaces of the first and second side walls 511 and 512 separately serve as the first and second space wall surfaces 54 and 55. The second side wall 512 may comprise a notch 513, which is formed downward or recessed from the top of the second side wall 512. The elastic strip element 532 may extend into the notch 513.

Referring to FIGS. 12 and 13, the notch 513 can be defined by a movement-impeding surface 5131 and a supporting surface 5132 both included in the second side wall 512. The movement-impeding surface 5131 may face forward. Specifically, the movement-impeding surface 5131 may be configured to face the side of the electrical card connector 5 where the opening 57 is located. The elastic strip element 532 does not interfere

with the movement-impeding surface 5131 when the elastic strip element 532 is not subjected to force. The movement-impeding surface 5131 can prevent excessive movement of the elastic strip element 532 due to large force, thereby preventing the elastic strip element 532 from being permanently deformed or damaged.

The supporting surface 5132 is under the elastic strip element 532 so that it can constrain the downward movement of the elastic strip element 532, thereby preventing the elastic strip element 532 from being damaged.

Referring to FIG. 13, the electrical card connector 5 may comprise a detective switch 58 disposed to control electrical connectivity of the plurality of terminals 52. Through the detective switch 58, the plurality of terminals 52 are enabled after the pads on the electrical card 6 respectively contact the plurality of terminals 52 during the insertion of the electrical card 6, and the plurality of terminals 52 are disabled before the pads on the electrical card 6 disengage from the plurality of terminals 52 during the removal of the electrical card 6d. The engaging portion of the detective switch 58 can be disposed behind the elastic strip element 532 so that if an electrical card 6 is incorrectly inserted, the electrical card 6 can be stopped before it engages the detective switch 58, thereby preventing the plurality of terminals 52 from being enabled, causing the electrical card 6 to be accidentally damaged.

Referring to FIGS. 12 to 14, the detective switch 58 can include a flexible member 581 and a stationary member 582. In one embodiment, the flexible member 581 normally contacts the stationary member 582 and is deflectable to disengage from the stationary member 582 if the detective switch 58 is a normally closed switch.

The flexible member 581 can be configured as a strip-like elastic arm, and includes an engaging portion 5811 extending from an edge of the flexible member 581 and bent to project into the card-receiving space 56 to contact with an inserted electrical card 2. The flexible member 581 can

include a distal end 5813 movable with the deflection of the flexible member 581 and a fixed end 5812 configured to be held by the insulating housing 51 and solderable to a printed circuit board, wherein the engaging portion 5811 can be disposed near the distal end 5813 so that a moment arm
5 of force can be larger, the flexible member 581 can be easily deflected, and an electrical card 6 can be easily inserted.

In addition, the flexible member 581 contacts the stationary member 582 by its one inner major surface. Because the engaging portion 5811 extends from an edge of the flexible member 581, the position of the inner
10 major surface configured to contact the stationary member 582 need not be taken into consideration when deciding the position of the engaging portion 5811.

The stationary member 582 can include a hook-like portion 5821 configured to extend around a side wall of the insulating housing 51. The
15 hook-like portion 5821 includes two ends, one connecting a touching portion 5822 that can contact the flexible member 581, the other attachable to the insulating housing 51 and solderable to a printed circuit board.

In one embodiment, the detective switch 58 can be a normally closed switch. In another embodiment, the detective switch 58 can be a normally
20 open switch.

Referring to FIGS. 13 and 14, when the electrical card connector 5 is configured to receive a micro SIM card, the metal shell 53 may include at least one stopper 533 bent downward from the top plate member 531 and formed opposite the opening 57 for indicating the end of insertion and
25 proper installation. In addition, the insulating housing 51 may include a stopper 514, which can be disposed with respect to the cut corner of the electrical card 6 and configured to mate with the cut corner.

One embodiment of the present invention proposes an electrical card connector including a shell mountable on an insulating housing. The shell

is provided with an elastic strip element extending transversely to the insertion direction of an electrical card for preventing incorrect insertion of an electrical card. The electrical card may comprise an insertion end, a cut corner formed on the insertion end, and a rear end opposite the insertion end.

5 The elastic strip element can configured such that it does not interfere with the insertion end while interfering with the rear end.

The above-described embodiments of the present invention are intended to be illustrative only. Persons skilled in the art may devise numerous alternative embodiments without departing from the scope of the
10 following claims.

What is claimed is:

1. An electrical card connector configured to receive an electrical card including an insertion end and a cut corner formed on the insertion end, the electrical card connector comprising:

5 an insulating housing;

a plurality of terminals attached to the insulating housing; and

a metal shell associated with the insulating housing to form a first space wall surface, a second space wall surface, a card-receiving space defined by the first and second space wall surfaces and an opening
10 communicating with the card-receiving space, wherein the insertion end of the electrical card is inserted into the card-receiving space through the opening, and the metal shell comprises:

a top plate member; and

an elastic strip element comprising a first end attached to the
15 top plate member and a second end opposite the first end, wherein the elastic strip element extends from the top plate member downward with the second end serving as a free end and in a direction from the first space wall surface toward the second space wall surface, wherein a distance between the first end and the first
20 space wall surface is greater than the width of the insertion end of the electrical card.

2. The electrical card connector of Claim 1, wherein the insulating housing comprises a first side wall comprising an inner wall surface serving as the first side wall and a second side wall comprising an
25 inner wall surface serving as the second space wall surface, wherein the second side wall comprises a notch recessed downward from the top of the second side wall and a movement impeding surface defining the notch; the movement impeding surface is configured to face the side of the electrical card connector where the opening is located and configured to impede the

movement of the elastic strip element to prevent the elastic strip element from being damaged.

3. The electrical card connector of Claim 2, wherein the second side wall comprises a supporting surface defining the notch and configured to constrain the downward movement of the elastic strip element.

4. The electrical card connector of Claim 3, further comprising a detective switch disposed behind the elastic strip element.

5. The electrical card connector of Claim 4, wherein the detective switch is a normally closed switch; the detective switch comprises a stationary member and a flexible member; the flexible member normally contacts the stationary member; the flexible member is deflectable to disengage from the stationary member; the flexible member comprises a distal end, an edge and an engaging portion that extends from the edge; and the engaging portion is bent to project into the card-receiving space and is disposed near the distal end.

6. The electrical card connector of any one of Claims 1 to 5, wherein the elastic strip element is a straight strip element.

7. The electrical card connector of Claim 6, wherein the metal shell further comprises at least one gap formed on the top plate member and along a side of the elastic strip element.

8. The electrical card connector of Claim 6, wherein the metal shell further comprises two gaps and the elastic strip element comprises a flat portion extending between the two gaps.

9. The electrical card connector of Claim 6, wherein the metal shell further comprises a stopper bent downward from the top plate member of the metal shell and formed opposite the opening.

10. The electrical card connector of Claim 6, wherein the insulating housing further comprises a stopper disposed with respect to the cut corner of the electrical card.