ELECTRICAL CARD CONNECTOR ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an electrical connector, and more particularly, to a stacked electrical card connector assembly.

2. Description of the Related Art

Many electronic devices include at least one electrical card connector to expand the functionality, and each electrical card connector includes a receptacle having an elongated slot and a plurality of terminals, which are disposed within the elongated slot and configured for electrically connecting a card module. Generally, a polarizing key is provided within the elongated slot to align with a notch on the card module to prevent the card module from incorrect installation. Conventionally, the polarizing key is formed integrally with the receptacle using plastic material such that the polarizing key is easily worn out and loses its functionality.

An electronic device may include several electrical card connectors for expanding its functionality, and in order to use the space of the electronic device more efficiently, multiple electrical card connectors may be mounted upon each other in stacked fashion.

FIG. 1 shows a prior art electrical connector assembly disclosed in U.S. Pat. Publication No. 2008/0,153,335. Referring to FIG. 1, U.S. Pat. Publication No. 2008/0,153,335 discloses an electrical connector assembly 1, which includes a pair of stacked insulative housings (10 and 20) and key elements 12 made of metal. Each metal key element 12 is inserted and retained within the elongated slot of the respective insulative housing (10 or 20) to divide the elongated slot into two parts with different lengths. A peg 15, which is punched from a metal plate, is provided to engage with both key elements 12 to interconnect the two stacked insulative housings (10 and

20). The electrical connector assembly 1 uses a metal key element 12 to overcome the tendency to wear out quickly; however, installing a key element 12 to each of the insulative housings (10 and 20) and a peg 15 between the two insulative housings (10 and 20) complicates the assembly process of the electrical connector assembly 1. Moreover, although the peg 15 is adopted to prevent the electrical connector assembly 1 from being broken and the peg 15 can engage the gaps 120 of key elements 12 respectively, the upper insulative housing 10 may still move relative to the lower insulative housing 20 because the peg 15 and the key elements 12 are not securely fixed together.

Although using metal keys in an electrical connector assembly can resolve the tendency to wear quickly, the metal keys have to be installed into the respective insulative housings separately, and the complex assembly increases cost. Moreover, the upper insulative housing may still have some motion relative to the lower insulative housing despite the peg, and such movement may still cause damage to the electrical connector assembly. Therefore, a new electrical card connector assembly for overcoming the above-mentioned issues is highly desired.

SUMMARY OF THE INVENTION

An objective of the present invention is to provide a new and improved electrical card connector assembly, which can simplify the assembly process thereof and prevent the relative movement and rotation between the stacked insulative housings of the electrical card connector assembly.

In order to achieve the above objective, an electrical card connector assembly is disclosed according to the first embodiment of the present invention. The electrical card connector assembly comprises a first insulative housing, a plurality of first terminals, a second insulative housing, a plurality of second terminals and a pin element. The first insulative housing includes a first card receiving recess and the second insulative housing includes a second card receiving recess. The second insulative

housing is stacked upon the first insulative housing. The first terminals are arrayed within the first insulative housing and are configured for electrically coupling to a card module inserted into the first card receiving recess. The second terminals are arrayed within the second insulative housing and are configured for electrically coupling to a card module inserted into the second card receiving recess. The pin element is configured to engage the first insulative housing and the second insulative housing. The pin element includes a first polarizing key section configured to be positioned within the first card receiving recess and a second polarizing key section configured to be positioned within the second card receiving recess.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 shows a prior art electrical connector assembly disclosed in U.S. Pat. Publication No. 2008/0,153,335;

FIG. 2 is a perspective view of an electrical card connector assembly mounted on a printed circuit board according to one embodiment of the present invention;

FIG. 3 is an exploded perspective view of FIG. 2;

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

FIG. 5 is an exploded perspective view of a back side of an electrical card connector assembly according to one embodiment of the present invention;

FIG. 6 shows a pin element and a cross-sectional perspective view of a second insulative housing according to one embodiment of the present invention;

FIG. 7 is a cross-sectional perspective view showing an assembly of a pin element, a first insulative housing and a second insulative housing according to one embodiment of the present invention;

FIG. 8 is a back side view showing a pin element and a cross-sectional perspective view of a second insulative housing according to one embodiment of the present invention;

FIG. 9 is a cross-sectional view showing the insertion of a pin element into a second insulative housing according to one embodiment of the present invention;

FIG. 10 is a cross-sectional view showing a second insulative housing inserted with a pin element and a separate first insulative housing according to one embodiment of the present invention;

FIG. 11 is a back side view showing a second insulative housing inserted with a pin element and a separate first insulative housing according to one embodiment of the present invention;

FIG. 12 is a cross-sectional view showing the insertion of a pin element into a first insulative housing and a second insulative housing according to one embodiment of the present invention;

FIG. 13 shows a front side view of FIG. 2;

FIG. 14 is a cross-sectional view of FIG. 13 along Y-Y;

FIG. 15 shows a top side view of FIG. 2; and

FIG. 16 is a cross-sectional view of FIG. 13 along Z-Z.

DETAILED DESCRIPTION OF THE INVENTION

As illustrated in FIG. 2 and FIG. 3, the present invention proposes an electrical card connector assembly 2 mounted on a printed circuit board 13, which includes a first insulative housing 21 and a second insulative housing

25. The first insulative housing 21 is laid flat upon the printed circuit board 13 and the second insulative housing 25 is stacked flatly upon the first insulative housing 21 such that the electronic card modules 4, each of which is received by the respective insulative housing 21 or 25, are arranged in such a way that these electronic card modules 4 occupy less area of the printed circuit board 13. The electronic card module 4 may include, for example, memory card module such as double data rate synchronous DRAM (DDR SDRAM, DDR2 SDRAM, and DDR3 SDRAM.) The electrical card connector assembly 2 further comprises a card module ejector 27, which is disposed upon the second insulative housing 25 and configured to eject the electronic card modules 4.

Referring to FIG. 4, the first insulative housing 21 has an elongated portion 210, in which a card receiving recess 211 is formed along the elongated direction thereof. The card receiving recess 211 is used to receive an electronic card module and is disposed on the surface of the card module receiving side of the elongated portion 210. A plurality of two types of lower terminals 212 and 213, which are inserted from the front side of the elongated portion 210, are alternately arrayed on the lower interior of the first insulative housing 21 and are electrically coupled to the lower side of an inserted card module, and a plurality of two types of upper terminals 221 and 222, which are inserted from the back side of the elongated portion 210, are alternately arrayed on the upper interior of the first insulative housing 21 and are electrically coupled to the upper side of an inserted card module such that an electrical connection between the inserted card module and the printed circuit board, on which the first insulative housing 21 is assembled, is established. The first insulative housing 21, moreover, comprises a pair of guiding arms 214, which are disposed at the two ends of the elongated portion 210 in parallel to define a card module accommodation space (not labeled). Each guiding arm 214 comprises a guiding groove 215, which is formed on the surface, surrounding the card module accommodation space, of the guiding arm 214. The guiding groove 215 of the guiding arm 214 is configured to guide an electronic card module

during insertion and removal of the electronic card module.

Similarly, the second insulative housing 25 has an elongated portion 250, in which a card receiving recess 251 is formed along the elongated direction thereof. The card receiving recess 251 is used to receive an electronic card module and is disposed on the surface of the card module receiving side of the elongated portion 250. A plurality of two types of lower terminals 252 and 253, which are inserted from the front side of the elongated portion 250, are alternately arrayed on the lower interior of the second insulative housing 25 and are electrically coupled to the lower side of an inserted card module, and a plurality of two types of upper terminals 262 and 263, which are inserted from the back side of the elongated portion 250, are alternately arrayed on the upper interior of the second insulative housing 25 and are electrically coupled to the upper side of an inserted card module such that such that an electrical connection between the inserted card module and the printed circuit board, on which the second insulative housing 25 is assembled, is established. The second insulative housing 25, moreover, comprises a pair of guiding arms 254, which are disposed at the two ends of the elongated portion 250 in parallel to define a card module accommodation space (not labeled). Each guiding arm 254 comprises a guiding groove 255, which is formed on the surface, surrounding the card module accommodation space, of the guiding arm 254. The guiding groove 255 of the guiding arm 254 is configured to guide an electronic card module during insertion and removal of the electronic card module.

As best seen in FIG. 5, the second insulative housing 25 additionally includes a stand-off portion 256. As the second insulative housing 25 is installed on a printed circuit board, the stand-off portion 256 rests upon the printed circuit board such that a space is formed underneath the guiding arm 254 of the second insulative housing 25, for accommodating the first insulative housing 21. When the first insulative housing 21 is assembled into the space underneath the guiding arm 254 of the second insulative housing 25, the first insulative housing 21 and the second insulative

housing 25 are stacked against each other as an electrical card connector assembly as shown in FIG. 14.

Referring to FIG. 4 again, the electrical card connector assembly of the present invention further comprises a pin element 28. The pin element 28 is used to engage the first insulative housing 21 and the second insulative housing 25 so that the first insulative housing 21 and the second insulative housing 25 can be joined securely together.

Referring to FIG. 6 and FIG. 7, the pin element 28 comprises a first polarizing key section 281 and a second polarizing key section 282, which are disposed oppositely and in parallel. After the electrical card connector assembly is assembled, the first polarizing key section 281 is positioned within the card receiving recess 211 of the first insulative housing 21, and the second polarizing key section 282 is positioned within the card receiving recess 251 of the second insulative housing 25. Both the first and second polarizing key sections 281 and 282 are provided to divide the card receiving recess 211 and 251 into two parts with different lengths so as to prevent card modules from incorrect installation as shown in FIG. 13.

Referring back to FIG. 6, the second polarizing key section 282 is received within a key section receiving cavity 257, which is configured to match the shape of the second polarizing key section 282 so as to retain the second polarizing key section 282 as shown in FIG. 9. Moreover, at least one of the interfering portions 2822 can be disposed on a side surface 2821 of the second polarizing key section 282 to firmly engage a respective surface defining the key section receiving cavity 257 when the second polarizing key section 282 is inserted into the key section receiving cavity 257. As such, the second polarizing key section 282 can be firmly held, as shown in FIG. 9, within the key second receiving cavity 257.

Referring to FIG. 8, the pin element 28 also includes a lengthy connecting section 283, and the second insulative housing 25 includes a connecting section receiving cavity 258, which is shaped to match the

configuration of the connecting section 283 such that when the connecting section 283 is inserted into the connecting section receiving cavity 258, the pin element 28 is firmly fixed to the second insulative housing 25 as shown in FIG. 9. As best seen in FIG. 6, the connecting section 283 can also include at least one interfering portion 2832, which can be disposed on a side surface 2831 to firmly engage the respective surface defining the connecting section receiving cavity 258. With the interfering portion 2832, the reliable connection between the connecting section 283 and the connecting section receiving cavity 258 can be ensured as shown in FIG. 9.

Referring to FIG. 10, a housing through hole 216, which penetrates the backside wall 217 of the first insulative housing 21 and connects to the card receiving recess 211, is configured to retain the first polarizing key section 281. As shown in FIGS. 10 and 12, the inside of the housing through hole 216 is matched with the external shape of the first polarizing key section 281 such that the first polarizing key section 281 is securely held within the housing through hole 216. With the cooperation of the connecting section 283 and the first polarizing key section 281, the first insulative housing 21 and the second insulative housing 25 can be directly connected by the pin element 28 so as to significantly simplify the assembly thereof. In addition to the above, the pin element 28 can properly align the two insulative housings 21 and 25 during assembly, and its configuration can also completely constrain the movement and rotation of the second insulative housing 25 relative to the first insulative housing 21.

Referring to FIG. 11, the first polarizing key section 281 may also include at least one interfering portion 2812, which protrudes from a side surface 2811 of the first polarizing key section 281. The interfering portion 2812 creates an interfering engagement with a respective surface defining the housing through hole 216 such that the first polarizing key section 281 is secured within the housing through hole 216. In the present embodiment, the pin element 28 can be made of metal or plastics harder than the plastic used to produce the first insulative housing 21 or the second insulative

housing 25.

Referring back to FIGS. 10 and 11, the first insulative housing 21 further comprises wedge-shaped portions 218, which are disposed on the top surface 220 of the elongated portion 210 according to one embodiment of the present invention. The wedge-shaped portion 218 has a configuration that includes a flat edge 2181 facing the card module receiving side and a slant edge 2182 facing away from the card module receiving side as shown in FIG. 10. Correspondingly, a surface, adjacent to the top surface 220 of the elongated portion 210, of the second insulative housing 25 is disposed with wedge-receiving grooves 258, which receive the respective wedge-shaped portions 218 after the two insulative housings 21 and 25 are assembled. The configuration of the wedge-shaped portion 218 allows the first insulative housing 21 to be easily assembled with the second insulative housing 25, but not easily disassembled from the second insulative housing 25 due to the flat edge 2181 thereof acting as a hindrance.

Referring to FIGS. 4 and 5, a guide slot 219 is formed on the upper side surface of each guiding arm 214 and a corresponding guide rail 259 is disposed on the lower surface of each guiding arm 254. Each guide rail 259 is shaped to slide in the respective guide slot 219. After the pin element 28 is installed in the second insulative housing 25, the guide rails 259 of the first insulative housing 21 are brought to fit into the respective guide slots 219 of the second insulative housing 25, and then the first insulative housing 21 is moved by the guidance of the guide slots 219 until the first polarizing key section 281 is inserted into the first insulative housing 21.

Referring to FIGS. 3, 15 and 16, the inserted card modules 4 are ejected using a card module ejector 27. The two opposite end portions 271 of the card module ejector 27 are shaped to slide upon the respective guiding arms 254 of the second insulative housing 25. As shown in FIG. 16, the card module ejector 27 further comprises a lower eject portion 272 engageable with the electronic card module received by the first insulative housing 21 and an upper eject portion 273 engageable with the electronic

card module received by the second insulative housing 25. The lower eject portion 272 and the upper eject portion 273 have different dimensions along the direction of card insertion such that the electronic card module received by the first insulative housing 21 and the electronic card module received by the second insulative housing 25 are ejected separately. As such, the card module ejection force can be lowered. The card module ejector 27 is inserted from the backside of the electrical card connector assembly, and is constrained to move only along the direction of electronic card module insertion.

Referring back to FIGS. 4, 5 and 16, the electrical card connector assembly is fixed to a printed circuit board using board lock elements 6, and each board lock element 6 extends downward from the respective guiding arm 214 of the second insulative housing 25. A plurality of shutter lock pins 5 are disposed on the first insulative housing 21. Each shutter lock pin 5 is held by a flexible pin fixture 260 and a pin holder 261, which are disposed on the backside surface of the respective guiding arm 254 as shown in FIG. 16. A plurality of barbs 51 of the shutter lock pin 5 interference-fit the inside surfaces of the respective flexible pin fixture 260 such that the shutter lock pin 5 is firmly held. The shutter lock pin 5 is installed on the route of installing the card module ejector such that the shutter lock pin 5 can prevent the card module ejector from disengaging from the electrical card connector assembly.

Referring to FIGS. 3 and 4, the first insulative housing 21 can receive two types of alternately arrayed lower terminals (212 and 213) and two type of alternatively arrayed upper terminals (221 and 222), and each of the lower terminals (212 and 213) and upper terminals (221 and 222) comprises a tail portion (2121, 2131, 2211 or 2221) extending downward to electrically couple to a printed circuit board. The tail portions 2121 and 2131 of the lower terminals (212 and 213) and the tail portions (2211 and 2221) of the upper terminals (221 and 222) are arranged in a staggered manner along the elongated direction of the insulative housing 21 such that

terminal receiving holes 71 used to receive the corresponding tail portions (2121, 2131, 2211 and 2221) on a printed circuit board can be arranged more densely as shown in FIG. 3 while eliminating the cross talking phenomenon between the adjacent terminal receiving holes 71.

Similarly, the second insulative housing 25 can receive two types of alternately arrayed lower terminals (252 and 253) and two types of alternately arrayed upper terminals (262 and 263). Each of the lower terminals (252 and 253) and the upper terminals (262 and 263) comprises a tail portion (2521, 2531, 2621 or 2631) extending downward to electrically couple to a printed circuit board. The tail portions 2521 and 2531 of the lower terminals (252 and 253) and the tail portions (2621 and 2631) of the upper terminals (262 and 263) are arranged in a staggered manner along the elongated direction of the insulative housing 25 such that terminal receiving holes 71 used to receive the corresponding tail portions (2521, 2531, 2621 and 2631) on a printed circuit board can be arranged more densely.

In summary, the electrical card connector assembly of the present invention includes two stacked insulative housings and a pin element. The pin element, which includes two polarizing key sections used to divide the card receiving recesses of the two stacked insulative housings into two parts with different lengths so as to prevent incorrect card module installation, is configured to join the stacked insulative housings. The pin element includes a connecting section firmly held by one insulative housing and a polarizing key section inserted into a housing through hole of the other insulative housing such that the two insulative housings are firmly connected. Using one pin element to connect two insulative housings can significantly simplify the assembly thereof and can properly align the two insulative housings during assembly, and the configuration of the pin element can also completely constrain the movement and rotation between the two insulative housings.

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. An electrical card connector assembly, comprising:

a first insulative housing including a first card receiving recess;

a plurality of first terminals arrayed within the first insulative housing and for electrically coupling to an electronic card module inserted into the first card receiving recess;

a second insulative housing which includes a second card receiving recess and is stacked upon the first insulative housing;

a plurality of second terminals arrayed within the second insulative housing and for electrically coupling to an electronic card module inserted into the second card receiving recess; and

a pin element configured to engage the first insulative housing and the second insulative housing, the pin element including a first polarizing key section configured to be positioned within the first card receiving recess and a second polarizing key section configured to be positioned within the second card receiving recess.

2. The electrical card connector assembly of Claim 1, wherein the pin element comprises a connecting section; the second insulative housing comprises a connecting section cavity having a shape matched with and configured to retain the connecting section; and the first insulative housing comprises a housing through hole having a shape matched with and configured to retain the first polarizing key section.

3. The electrical card connector assembly of Claim 2, wherein the connecting section includes a first interfering portion disposed on a side surface of the connecting section to firmly engage a respective surface defining the connecting section receiving cavity, and the first polarizing key section includes a second interfering portion disposed on a side surface of the first polarizing key section to firmly engage a respective surface defining the housing through hole.

4. The electrical card connector assembly of Claim 3, wherein the second insulative housing further comprises a key section receiving cavity for receiving the second polarizing key section, and the second polarizing key section includes a third interfering portion disposed on a side surface of the second polarizing key section to firmly engage a respective surface defining the key section receiving cavity.

5. The electrical card connector assembly of Claim 4, wherein the first insulative housing further comprises a wedge-receiving groove and the second insulative housing further comprises a wedge-shaped portion disposed correspondingly to and configured to engage the wedge-receiving groove, wherein the wedge-shaped portion has a flat edge facing toward a card module receiving side of the electrical card connector assembly to prevent separating the first insulative housing from the second insulative housing.

6. The electrical card connector assembly of Claim 5, wherein the first insulative housing further comprises a guide slot and the second insulative housing further comprises a guide rail, which is disposed correspondingly to and shaped to slide in the guide slot, wherein when the first insulative housing and the second insulative housing are being assembled, the guide rail engages the guide slot such that the movement of the first insulative housing and the second insulative housing are guided.

7. The electrical card connector assembly of Claim 6, wherein each of the first insulative housing and the second insulative housing further comprises a pair of guiding arms disposed on two ends thereof, and each guiding arm comprises a guiding groove configured to guide an electronic card module during insertion or removal of the electronic card module.

8. The electrical card connector assembly of Claim 7, wherein the second insulative housing further comprises a stand-off portion, wherein the stand-off portion rests upon a printed circuit board such that a space is

formed underneath the guiding arm of the second insulative housing, for accommodating the first insulative housing.

9. The electrical card connector assembly of Claim 8, further comprising a card module ejector having two end portions, each end portion being shaped to slide upon the respective guiding arm of the second insulative housing, wherein the card module ejector comprises a lower eject portion engageable with a first inserted electronic card module received by the first insulative housing and an upper eject portion engageable with a second inserted electronic card module received by the second insulative housing, and the lower eject portion and the upper eject portion have different dimensions along the direction of card insertion such that the first inserted electronic card module and the second inserted electronic card module can be separately ejected.

10. The electrical card connector assembly of Claim 9, further comprising a pair of shutter lock pins disposed on the first insulative housing and behind the card module ejector to prevent the card module ejector from disengaging.

11. The electrical card connector assembly of Claim 10, further comprising a plurality of board lock elements configured to secure the electrical card connector assembly to the printed circuit board, wherein each board lock element extends downward from the respective guiding arm of the second insulative housing.

12. The electrical card connector assembly of Claim 11, further comprising a plurality of third terminals and a plurality of fourth terminals, wherein the first terminals are electrically coupled to a lower side of the first inserted electronic card module; the third terminals are electrically coupled to an upper side of the first inserted electronic card module; the second terminals are electrically coupled to a lower side of the second inserted electronic card module; and the fourth terminals are electrically

coupled to an upper side of the second inserted electronic card module.

13. The electrical card connector assembly of Claim 12, wherein each of the first terminal, the second terminal, the third terminal and the fourth terminal comprises a tail portion configured to electrically connect the printed circuit board, and the tail portions of each of the arrayed within first terminals, the arrayed within second terminals, the arrayed within third terminals and the arrayed within fourth terminals are in a staggered manner along an elongated direction of the electrical card connector assembly.