

STACKING CONNECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a stacking connector.

2. Description of the Related Art

Connectors are widely utilized as means to connect two devices for communication or data transmission. To meet the requirement of the transmission of large quantities of data, the data transfer speed is continuously being increased. As the data transfer speed increases, connectors designed for lower transmission speed may have to be redesigned to ensure signal integrity.

FIG. 1 shows a conventional stacking connector 1, and FIG. 2 shows a plurality of terminals 2 and 9 arrayed in the stacking connector 1. The stacking connector 1 includes a housing 11 having upper and lower receptacles 111 and 112 configured to separately hold the contact portions 21 and 91 of the terminals 2 and 9 juxtaposed along the housing 11. The plurality of upper and lower terminals 2 and 9 are densely arranged so that the space required by the stacking connector 1 can be small. Each of the plurality of upper and lower terminals 2 and 9 further includes a barbed portion 22 or 92 connected to the contact portion 21 or 91 and an extension portion 23 or 93 connected to the barbed portion 22 or 92. The extension portion 23 or 93 extends from the barbed portion 22 or 92, is bent vertically, and then extends straight to form an end that can be configured to be soldered to a through hole on a printed circuit board.

The plurality of upper terminals 2 partially received in the upper receptacle 111 may include two differential pairs 24 and 25, between which a ground pin 26, having a similar configuration to that of the terminal 2 of the differential pairs 24 and 25, is disposed. Similarly, the plurality of lower

terminals 9 partially received in the lower receptacle 112 may include two differential pairs 94 and 95 and a ground pin 96 disposed between the two differential pairs 94 and 95. The terminals 2 of two differential pairs 24 and 25 received in the upper receptacle 111 have extension portions 23 longer than the extension portions 93 of the lower terminals 9 partially received in the lower receptacle 112. Accordingly, when the terminals 2 of the two differential pairs 24 and 25 are adapted for high speed data transmission, for example 3Gbps, signal integrity cannot be ensured due to their longer extension portions 23. In addition, the ground pin 26 or 96 having a configuration similar to the terminal 2 or 9 cannot provide sufficient shielding effectiveness, resulting in poor signal integrity.

Further, the extension portion 23 or 93 of the terminal 2 or 9 is vertically bent, and such vertically bent terminals 2 may also affect the transmission of signals.

In light of the above-mentioned problems, the conventional stacking connector cannot satisfy high speed transmission requirements, and therefore a new stacking connector for high signaling speed is required.

SUMMARY OF THE INVENTION

An objective of the present invention is to provide a new and improved stacking connector that can be adapted for high speed data transmission.

In order to achieve the above objective, one embodiment of the present invention provides a stacking connector, which comprises a dielectric housing, two first differential pairs, two second differential pairs, and a shield terminal.

The dielectric housing comprises a first receptacle and a second receptacle vertically juxtaposed.

Each first differential pair includes a plurality of first terminals. Each first terminal includes a contact portion, a retention portion, an extension

portion, and a solder tail portion, wherein the contact portion of the first terminal extends within the first receptacle, the retention portion of the first terminal extends between the contact portion of the first terminal and the extension portion of the first terminal, and the extension portion of the first terminal extends between the retention portion of the first terminal and the solder tail portion of the first terminal.

Each second differential pair includes a plurality of second terminals. Each second terminal includes a contact portion, a retention portion, an extension portion, and a solder tail portion, wherein the contact portion of the second terminal extends within the second receptacle, the retention portion of the second terminal extends between the contact portion of the second terminal and the extension portion of the second terminal, and the extension portion of the second terminal extends between the retention portion of the second terminal and the solder tail portion of the second terminal.

The shield terminal includes a plate portion and two contact portions. The two contact portions separately extend within the first receptacle and the second receptacle. The shield terminal is disposed between the two first differential pairs and between the two second differential pairs. The plate portion is configured to separate the extension portions of the plurality of first terminals of one first differential pair from the extension portions of the plurality of first terminals of another first differential pair, and to separate the extension portions of the plurality of second terminals of one second differential pair from the extension portions of the plurality of second terminals of another second differential pair.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 shows a conventional stacking connector;

FIG. 2 shows the plurality of terminals 2 arrayed in the stacking connector of FIG. 1;

FIG. 3 is a front perspective view showing a stacking connector according to one embodiment of the present invention;

5 FIG. 4 is a rear perspective view of the stacking connector of FIG. 3;

FIG. 5 is a perspective, sectional view of the stacking connector of FIG. 4 according to one embodiment of the present invention;

(FIG. 6 is an exploded perspective view showing a stacking connector according to one embodiment of the present invention;

10 FIG. 7 is a perspective view showing two first differential pairs, two second differential pairs and a shield terminal according to one embodiment of the present invention;

FIG. 8 is a side view of the two first differential pairs, the two second differential pairs and the shield terminal of FIG. 7;

15 FIG. 9 is a rear view of the two first differential pairs and the shield terminal of FIG. 7;

(FIG. 10 is an exploded perspective view showing the two first differential pairs, the two second differential pairs and the shield terminal of FIG. 7;

20 FIG. 11 is a rear view showing a stacking connector according to one embodiment of the present invention;

FIG. 12 is a cross-sectional view along line Z-Z of FIG. 10; and

FIG. 13 is a cross-sectional view along line Y-Y of FIG. 10.

DETAILED DESCRIPTION OF THE INVENTION

25 As illustrated in FIGS. 3 to 6, one embodiment of the present invention

proposes a new stacking connector 3. The stacking connector 3 comprises a dielectric housing 31 comprising a first receptacle 311 and a second receptacle 312, a shield terminal 32, two first differential pairs 4 and 5, and two second differential pairs 6 and 7.

5 Referring to FIG. 3, the first receptacle 311 and the second receptacle 312, respectively protruding forward from a main body 313, are juxtaposed in a vertical direction indicated by arrow X. The first receptacle 311 may include a slot 3111 configured for receiving a mating plug connector. The slot 3111 can be a single slot extending within the first receptacle 311, or
10 can be segmented by a partition 3112 as shown in FIG. 3. Similarly, the second receptacle 312 may also include an internally extending single slot 3121 for receiving a mating plug connector. The slots 3121 may also be segmented by a partition 3122 as shown in FIG. 3.

Referring to FIGS. 3 and 6, the dielectric housing 31 may comprise two
15 side walls 314 protruding backward from the main body 313, defining an accommodation space. On the external wall surface of each side wall 314, a fixing portion 315 can be disposed. The fixing portion 315 can be near the bottom edge of the respective side wall 314 and is configured to hold a board lock 37, by which the stacking connector 3 can be fixed to a printed
20 circuit board.

Referring to FIG. 6, a lower protrusion 3141 can be disposed on the inner surface of each side wall 314, extending along the bottom edge of the side wall 314. Moreover, a middle protrusion 3142 can be disposed on the inner surface of each side wall 314, parallel to and separated from the lower protrusion 3141 by a gap 3144. The stacking connector 3 may further
25 comprise two plate members 38, on which a plurality of through holes 381 are formed. On the two opposite side edges of each plate member 38, recesses 382 and projected portions 383 are formed. Correspondingly, on a side surface of each lower protrusion 3141 facing the accommodation space,
30 two juts 3143 are formed to engage the respective recesses 382 so that the plate members 38 are guided while they are being assembled, and the plate

members 38 can be constrained after they are assembled. The projected portion 383 extends widthwise and is disposed adjacent to the top surface of the plate member 38. In addition, the projected portion 383 is configured to interfere with the lower protrusion 3141 and to be received by the
5 respective gap 3144, and to be held between the middle protrusion 3142 and the lower protrusion 3141 after the plate member 38 is installed.

Referring to FIGS. 6, 7, 11, and 13, each of the first differential pairs 4 and 5 may comprise a pair of first terminals 33a and 33b used for differential signaling. Each of the first terminals 33a and 33b may comprise
10 a contact portion 331 configured to extend above the slot 3111 and partially protrude into the slot 3111, a retention portion 332, an extension portion 333a or 333b, and a solder tail portion 334 configured to extend through the respective through hole 381 in the plate members 38. The retention portion 332 is configured to extend between the contact portion 331 and the
15 extension portion 333a or 333b, and the extension portion 333a or 333b is configured to extend between the retention portion 332 and the solder tail portion 334. Each of the second differential pairs 6 and 7 may comprise a pair of second terminals 34a and 34b used for differential signaling. Each of the second terminals 34a and 34b may comprise a contact portion 341
20 configured to extend above the slot 3121 and partially protrude into the slot 3121, a retention portion 342, an extension portion 343a or 343b, and a solder tail portion 344 configured to extend through the respective through hole 381 in the plate members 38. The retention portion 342 is configured to extend between the contact portion 341 and the extension portion 343a or
25 343b, and the extension portion 343a or 343b is configured to extend between the retention portion 342 and the solder tail portion 344.

Referring to FIG. 10, the shield terminal 32 may include a plate portion 321 having a first side edge 3211 and disposed within the accommodation space, a lower contact portion 322 protruding forward from the first side
30 edge 3211, an upper contact portion 323 protruding forward from the first side edge 3211, and a solder tail portion 324 protruding downward from the

plate portion 321 and configured for being soldered to a ground connection point of a printed circuit board. Referring to FIGS. 10 and 12, the lower contact portion 322 is configured to extend within the second receptacle 312, above the slot 3121, with a part of the lower contact portion 322 protruding into the slot 3121 for electrically engaging a mated connector. The upper contact portion 323 is configured to extend within the first receptacle 311, above the slot 3111, with a part of the upper contact portion 323 protruding into the slot 3111 for electrically engaging a mated connector. As shown in FIG. 10, a plurality of notches 3212 can be formed on the first side edge 3211 of the plate portion 321 so as to divide the first side edge 3211 into several segments 3213. Correspondingly, a plurality of slits 316, as shown in FIG. 6, can be formed for receiving the segments 3213. Thus, the shield terminal 32 can be properly held after it is installed.

As shown in FIG. 12, two holes 317 can be separately formed to communicate the slot 3111 with the respective slit 316 and to communicate the slot 3121 with the respective slit 316, respectively allowing the lower and upper contact portions 322 and 323 to be inserted into the slots 3111 and 3121. Two barb portions 318 can be separately formed between the plate portion 321 and the lower contact portion 322, and between the plate portion 321 and the upper contact portion 323. The barb portions 318 are configured to engage the respective holes 317 so as to secure the shield terminal 32 to the dielectric housing 31.

Referring to FIGS. 7, 8, 9, 11, and 13, the shield terminal 32 can be grounded and is configured to be disposed between the two first differential pairs 4 and 5 and between the second differential pairs 6 and 7, as shown in FIG. 7. Referring to FIGS. 7 and 8, the plate portion 321 of the shield terminal 32 is configured to separate or hide the extension portions 333a and 333b of the first terminals 33a and 33b of one first differential pair 4 from the extension portions 333a and 333b of the first terminals 33a and 33b of another first differential pair 5 such that the coupling and crosstalk between the two first differential pairs 4 and 5 can be reduced and the signal

transmission speed can be increased. Furthermore, the plate portion 321 of the shield terminal 32 is also configured to separate or hide the extension portions 343a and 343b of the second terminals 34a and 34b of one second differential pair 6 from the extension portions 343a and 343b of the second terminals 34a and 34b of another second differential pair 7 such that the coupling and crosstalk between the two second differential pairs 6 and 7 can be reduced and the signal transmission speed can be increased. Specifically, the plate portion 321 includes an upper edge 3214 configured to be higher than the higher end portions of the extension portions 333a and 333b connecting to the respective retention portions 332, a lower edge 3215 configured to be lower than the lower end portions of the extension portions 343a and 343b connecting to the respective retention portions 342, and a second side edge 3216 correspondingly configured to be away from the dielectric housing 31 farther than the extension portions 333a and 333b of the first terminals 33a and 33b.

Referring to FIGS. 6 to 9, the stacking connector 3 may further comprise two first ground terminals 35 each disposed adjacent to the respective one of the first differential pairs 4 and 5 and opposite to the shield terminal 32, and two second ground terminals 36 each disposed adjacent to the respective one of the second differential pairs 6 and 7 and opposite to the shield terminal 32. Each first ground terminal 35 may comprise a contact portion 351 configured to partially protrude into the slot 3111, a retention portion 352, an extension portion 353, and a solder tail portion 354 configured to extend through the respective through hole 381 in the plate members 38. The retention portion 352 is configured to extend between the contact portion 351 and the extension portion 353, and the extension portion 353 is configured to extend between the retention portion 352 and the solder tail portion 354. Correspondingly, each second ground terminal 36 may comprise a contact portion 361 configured to partially protrude into the slot 3121, a retention portion 362, an extension portion 363, and a solder tail portion 364 configured to extend through the respective through hole 381 in the plate members 38. The retention portion

362 is configured to extend between the contact portion 361 and the extension portion 363, and the extension portion 363 is configured to extend between the retention portion 362 and the solder tail portion 364.

Referring to FIGS. 7 to 9, the first terminals 33a and 33b of each of the first differential pairs 4 and 5 and the ground terminal 35 disposed adjacent thereto may be juxtaposed, and the extension portions 333a, 333b and 353 of the first terminals 33a and 33b and the ground terminal 35 may be arranged in a manner that can facilitate coupling of signals. To this end, the widened sections of the first terminals 33a and 33b of each first differential pair are differently spaced from the dielectric housing 31, and the widened section of one first terminal 33b next to the respective first ground terminal 35 has a width greater than a spaced distance between the respective first ground terminal 35 and another first terminal 33a. Specifically, the widened section of the extension portion 333b of the first terminal 33b is disposed away from the dielectric housing 31 farther than the widened sections of the extension portions 333a and 353 of the first terminals 33a and the ground terminal 35, and the widened section of the extension portion 333b of the first terminal 33b may further widthwise extend to have a width greater than the spaced distance between the widened sections of the extension portion 333a of the first terminal 33a and the extension portion 353 of the ground terminal 35, as shown in FIG. 9. Thus, the edge portions of the widened sections of the extension portion 333b can separately overlap the edge portion of the widened section of the extension portion 333a and the widened section of the extension portion 353, resulting in better coupling of signals.

Referring to FIGS. 7 and 8, each of the extension portions 333a, 333b, and 353 of the first terminals 33a and 33b and the ground terminals 35 may include two obtuse bends 367 and 368 such that the contact portion 331 of each first terminals (33a or 33b) and the corresponding solder tail portion 334 of the first terminal (33a or 33b) can extend in different directions, and the contact portion 351 of the first ground terminal 35 and the solder tail

portion 354 of the first ground terminal 35 can extend in different directions. In addition, due to the application of the obtuse bends 367 and 368, the first terminals 33a and 33b and the ground terminals 35 do not have to be sharply bent; therefore, signal transmission can be improved. In the present embodiment, the angle of the two obtuse bends 367 and 368 can be, but is not limited to, 135 degrees.

Referring to FIGS. 6 and 7, a plurality of arrayed terminal holes 51 and 52 can be formed through the main body 313 of the dielectric housing 31 and can be communicated to the respective slots 3111 and 3121. The retention portion 332, 342, 352 or 362 of each of the first terminals 33a and 33b, the second terminals 34a and 34b, and the ground terminals 35 and 36 may include a plurality of oppositely protruding barbs 3321, 3421, 3521 or 3621 configured for secure engagement with two opposite side walls defining the respective terminal hole 51 or 52. In addition, the contact portions 331, 341, 351 and 361 of the first terminals 33a and 33b, the second terminals 34a and 34b, and the ground terminals 35 and 36 are inserted into the respective receptacles 311 and 312 through the terminal holes 51 and 52 such that each terminal hole 51 or 52 is configured to be widened vertically so as to allow the respective contact portion 331, 341, 351 or 361 to pass through and to enter into the respective receptacle 311 or 312.

In addition, the barbs 3321 of the first terminals 33 can be aligned in a direction parallel to the array direction of the first terminals 33 such that the signal integrity of the signals transmitted on the first terminals 33 can be ensured. Similarly, the barbs 3421 of the second terminals 34 can be aligned in a direction parallel to the array direction of the second terminals 34 such that the signal integrity of the signals transmitted on the second terminals 34 can be ensured.

Referring to FIGS. 3 and 6, the stacking connector 3 may further comprise a plurality of first power terminals 41 each including a contact portion 411 extending below and partially protruding into the slot 3111

within the first receptacle, a plurality of first signal terminals 42 each including a contact portion 421 extending below and partially protruding into the slot 3111 within the first receptacle, a plurality of second power terminals 43 each including a contact portion 431 extending below and partially protruding into the slot 3121 within the second receptacle, and a plurality of second signal terminals 44 each including a contact portion 441 extending below and partially protruding into the slot 3121 within the second receptacle.

In summary, the stacking connector of the above-described embodiment of the present invention comprises a shield terminal having a plate portion configured to separate one first differential pair from another first differential pair and to separate one second differential pair from another second differential pair so that the coupling and crosstalk between the two first differential pairs and between the two second differential pairs can be reduced and the signal transmission speed of the differential pairs can be increased. Each terminal of the differential pairs includes two obtuse bends, resulting in improved signal transmission.

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 stacking connector, comprising:

a dielectric housing comprising a first receptacle and a second receptacle vertically juxtaposed;

5 two first differential pairs, each first differential pair including a plurality of first terminals, each first terminal having a contact portion, a retention portion, an extension portion, and a solder tail portion, wherein the contact portion of the first terminal extends within the first receptacle, the retention portion of the first terminal extends between the contact portion of
(10 the first terminal and the extension portion of the first terminal, and the extension portion of the first terminal extends between the retention portion of the first terminal and the solder tail portion of the first terminal;

two second differential pairs, each second differential pair including a plurality of second terminals, each second terminal having a contact
15 portion, a retention portion, an extension portion, and a solder tail portion, wherein the contact portion of the second terminal extends within the second receptacle, the retention portion of the second terminal extends between the contact portion of the second terminal and the extension
portion of the second terminal, and the extension portion of the second
(20 terminal extends between the retention portion of the second terminal and the solder tail portion of the second terminal; and

a shield terminal including a plate portion and two contact portions, the plate portion and two contact portions being integrally formed, the two contact portions separately extending within the first receptacle and the
25 second receptacle, the plate portion of the shield terminal disposed between the two first differential pairs and between the two second differential pairs, wherein the plate portion is configured to separate the extension portions of the plurality of first terminals of one first differential pair from the extension portions of the plurality of first terminals of another first
30 differential pair, and to separate the extension portions of the plurality of second terminals of one second differential pair from the extension portions

of the plurality of second terminals of another second differential pair.

2. The stacking connector of Claim 1, wherein the shield terminal further comprises at least an integrally formed solder tail portion configured for grounding.

5 3. The stacking connector of Claim 2, further comprising two first ground terminals and two second ground terminals, wherein each first ground terminal is disposed adjacent to a respective one of the first differential pairs and opposite to the shield terminal, and each second ground terminal is disposed adjacent to a respective one of the second differential pairs and opposite to the shield terminal.

4. The stacking connector of Claim 3, wherein each of the extension portions of the first terminals and the first ground terminal comprises a widened section.

15 5. The stacking connector of Claim 4, wherein the widened sections of the first terminals of each first differential pair are differently spaced from the dielectric housing, and the widened section of one first terminal next to the respective first ground terminal has a width greater than a spaced distance between the respective first ground terminal and another first terminal.

20 6. The stacking connector of Claim 5, wherein each of the extension portions of the first terminal and the first ground terminal comprises two obtuse bends.

25 7. The stacking connector of Claim 6, wherein the retention portion of each of the first terminal and the second terminal comprises a plurality of barbs, the barbs of the plurality of first terminals are aligned in a direction parallel to an array direction of the plurality of first terminals, and the barbs of the plurality of second terminals are aligned in a direction

parallel to an array direction of the plurality of second terminals.

8. The stacking connector of Claim 3, further comprises a plurality of first power terminals each including a contact portion extending within the first receptacle, a plurality of first signal terminals each including
5 a contact portion extending within the first receptacle, a plurality of second power terminals each including a contact portion extending within the second receptacle, and a plurality of second signal terminals each including a contact portion extending within the second receptacle.

9. The stacking connector of Claim 8, wherein the dielectric
10 housing comprises two side walls, wherein the shield terminal is disposed between the two side walls.

10. The stacking connector of Claim 9, further comprising a plurality of plate members each having oppositely disposed projected portions, and each side wall comprises a lower protrusion and a middle
15 protrusion separated from the lower protrusion, wherein each projected portion is configured to interfere with the respective lower protrusion and to be held between the respective lower protrusion and the middle protrusion.