

CARD EDGE CONNECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a card edge connector, and more particularly, to a card edge connector having a thinned-down feature, which
5 can solve instability, cracking and warpage issues.

2. Description of the Related Art

Card edge connectors are widely used in the electronics industry. An edge connector is configured to receive a printed circuit board with a
10 mating edge having a plurality of contact pads adjacent to the edge. Generally, such card edge connectors have an elongated insulating housing with an elongated receptacle for receiving the mating edge of the printed circuit board. A plurality of terminals are arrayed along one or both sides of the receptacle for electrically coupling to the contact pads. In many
15 applications, the card edge connector is mounted to a second printed circuit board, called the "mother board" to receive the mating edge board, called the "daughter board."

One problem with card edge connectors arises from the increasing demands for high-density electronic circuitry. The terminals of such a card
20 edge connector are inserted within an insulating housing fabricated of dielectric material such as plastic. The terminals are disposed in rows along the receptacle of the insulating housing, separated by partitions. Two adjacent partitions are usually span supported by a rib. The high-density requirement of the connector results in the insulating housing portions
25 receiving the terminals being extremely thin. Not only does this result in the insulating housing portions potentially providing insufficient support for the terminals, but also adds to the stresses placed on the insulating housing due to the insertion of the terminals, resulting in damage.

Referring to FIG. 1, for example, a terminal 1 usually has side locking lock-barbs 11 for retention of the terminal 1 within the insulating housing. During insertion of a terminal 1, the barbs 11 dig into the corresponding sidewalls of retention slots in the partitions to retain the terminal 1 within the insulating housing. However, such a terminal 1 with lock-barbs 11 can easily crack the rib span supporting the partitions during insertion if there is too much interference or if there are too many fold/weld lines. The rib is cracked due to the compression force coming from the lock-barbs, which are in full contact. In addition, the side locking lock-barbs can also cause the insulating housing to warp. Furthermore, because the insulating housing is made of plastics with deformable nature, the damage may be worsened by terminal insertion interference caused by manufacturing variations.

Referring to FIG. 2, for another example, the terminal 2 with lancing lock-barbs 21 represents another type of terminal, which may cause a problem with unstable locking. The insulating housing portions are easily damaged by the lancing lock-barbs during insertion, and the damaged insulating housing portions will cause the inserted terminals to be unstable under the effect of external force. The unstable terminals are loosely held, and their contact portions, engaging the contact pads of a daughter board and tail portions mounted on a motherboard, are easily forced out of their installed positions.

Therefore, it is now desirable for a new terminal design that resolves the above-mentioned issues causing damage to the insulating housing of the card edge connector.

SUMMARY OF THE INVENTION

An objective of the present invention is to provide a new and improved card edge connector with fewer insertion problems.

In order to achieve the above objective, a card edge connector for

receiving a card module is disclosed according to the first embodiment of the present invention. The card edge connector comprises an insulating housing and a plurality of terminals. The insulating housing mounted on a printed circuit board comprises a card edge receptacle configured for receiving the mate edge of a card module, a plurality of terminal-receiving cavities arrayed along the insulating housing, a plurality of transverse walls disposed along the insulating housing and corresponding to the terminal-receiving cavities and a plurality of retaining surfaces disposed corresponding to the terminal-receiving cavities. Each transverse wall spans the insulating housing. Each terminal-receiving cavity is separated from adjacent terminal-receiving cavities in a direction along the insulating housing by the corresponding transverse walls. Each terminal-receiving cavity is provided with the corresponding retaining surface disposed on one of the adjacent transverse walls. The card module includes a plurality of contact pads. The terminals are configured for electrically interconnecting the contact pads and the printed circuit board. Each terminal is received in the corresponding terminal-receiving cavity and comprises at least one retention portion that includes a thinned-down section disposed corresponding to the retaining surface, wherein the thinned-down section includes a retention member laterally protruding beyond a side edge of the retention portion to engage the retaining surface.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 shows an example of a prior art terminal;

FIG. 2 shows another example of a prior art terminal;

FIG. 3 illustrates a card edge connector according to one embodiment of the present invention;

FIG. 4 shows a pair of terminal-receiving cavities configured to receive

first and second terminals according to one embodiment of the present invention;

FIG. 5 is an exploded diagram showing a pair of terminal-receiving cavities and first and second terminals according to one embodiment of the present invention;

FIG. 6 shows a two-stepped groove according to one embodiment of the present invention;

FIG. 7 shows an alternate arrangement for first terminals and second terminals according to one embodiment of the present invention;

FIG. 8 is a sectional view of the bottom of the insulating housing according to one embodiment of the present invention;

FIG. 9 is a cross-sectional view of FIG. 8 along Z-Z;

FIG. 10 shows an enlarged perspective view of the area denoted in FIG. 9;

FIG. 11 shows the front side view of a first terminal and a second terminal according to one embodiment of the present invention;

FIG. 12 shows an enlarged perspective view of the area denoted in FIG. 11;

FIG. 13 shows the back side view of a first terminal and a second terminal; and

FIG. 14 shows an enlarged perspective view of the area denoted in FIG. 13.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 3, an elongated electrical card connector 30 of the edge card type is shown. The card edge connector 30 comprises a unitarily

molded, elongated insulating housing 31, a pair of latch members 32 disposed at opposite ends of the insulating housing 31 for retaining and ejecting a card module 40 and a plurality of first and second terminals 33a and 33b received within the insulating housing 31. The insulating housing 31, defined by a board-mounting face 311 and a board-receiving face 312, having a pair of extended portions 313, each of which extends in a direction beyond the board-mounting face 311 and receives the corresponding latch member 32 pivotable and rotatable therein, comprises a card edge receptacle 314 and a plurality of terminal-receiving cavities 315. The card edge receptacle 314 configured for receiving the mate edge 41 of the card module 40 on which is disposed a plurality of contact pads 42 extends in the longitudinal direction of the insulating housing 31. The paired and spaced terminal-receiving cavities 315, configured for receiving first and second terminals 33a and 33b, are arrayed in two separate rows 34a and 34b along the insulating housing 31, and each of rows 34a and 34b is spaced apart from one another to define the card edge receptacle 314 therebetween. The terminal-receiving cavities 315 in each of rows 34a and 34b can be arranged at substantially equal intervals. Each of the rows 34a and 34b is generally parallel to the mate edge 41. Finally, a polarizing rib 35 spans the card edge receptacle 314 and is configured for engaging a polarizing notch 43 on the mate edge 41 of the card module 40 to ensure that the card module 40 is properly oriented before insertion into the card edge receptacle 314.

Generally, the card edge connectors 30 are mounted on a printed circuit board 50, which is commonly called the "motherboard." In order to insert the card edge connector 30 onto the printed circuit board 50 appropriately, the card edge connector 30 includes at least one guide post 36 received by a corresponding hole 51 on the printed circuit board 50.

Referring to FIGS. 4-5, the insulating housing 31 comprises a series of pairs of spaced-apart terminal-receiving cavities 315 with one pair of the terminal-receiving cavities 315 shown in each of FIG. 4 and FIG. 5. As depicted in the drawings, two terminal receiving cavities 315 in a pair may

be substantially exactly opposite and substantially mirror-image identical. Each transverse wall 316 spans the insulating housing 31. Each terminal-receiving cavity 315 is separated from adjacent terminal-receiving cavities 315 in a direction along the insulating housing 31 by the corresponding transverse walls 316.

Referring to FIGS. 3-4, a rib 317 is disposed in the lower half of the insulating housing 31 and spans terminal-receiving cavities 315. The rib 317 separates two terminal-receiving cavities 315 in a pair, is joined with two adjacent transverse walls 316 and thereby provides support for the transverse walls 316. The ribs 317 and the transverse walls 316 can be integrally molded so as to allow the transverse walls 316 to be made as thin as possible. Each rib 317 has a tapered end 3171 configured for assisting the first and second terminals 33a and 33b to be inserted into the corresponding terminal-receiving cavities 315.

Referring to FIGS. 5-6, each transverse wall 316 comprises a pair of inner recesses 3161, a pair of middle recesses 3162 and a pair of outer recesses 3163, all of which are formed on a bottom edge 3164 of the transverse wall 316. The inner recess 3161 is placed near the rib 317; the outer recess 3163 is placed adjacent to a sidewall 318 of the insulating housing 30 and the middle recess 3162 is placed between the inner recess 3161 and the outer recess 3163. As best seen in FIG. 6, each terminal-receiving cavity 315 is provided with a pair of grooves 3165 formed on the opposite facing wall surfaces 3166 within terminal-receiving cavity 315. Each groove extends toward the board-receiving surface 312 from the bottom 3167 of the corresponding middle recess 3162 (as shown in FIG. 5). The groove 3165, which is a two-stepped groove, has a deep groove part 31651 and a shallow groove part 31652, which is farther away from the bottom 3167 than the deep groove part 31651. The shallow groove part 31652 includes a retaining surface 3168 configured for retaining the corresponding one of the first and second terminals 33a and 33b by engaging therewith.

Referring to FIG. 3, FIG. 5 and FIG. 11, each first terminal 33a comprises an arcuate contact portion 331a, a retention portion 332a, an extension portion 333a and a connection portion 334a. The contact portion 331a projects vertically and inward from one end 3321a of the retention portion 332a (inward in relation to the terminal receiving cavity 315). Each
5 inserted contact portion 331a is bowed into the card edge receptacle 314 to engage the corresponding contact pad 42 with the inserted mate edge 41. The extension portion 333a extends horizontally and inward from the other end 3323a of the retention portion 332a. The connection portion 334a
10 extends downward from the end 3331a of the extension portion 333a. The retention portion 332a includes a pair of retention members 3322a at opposite side edges thereof. The connection portion 334a includes support sections 3341a at opposite side edges thereof and adjacent to the end 3331a of the extension portion 333a. The connection portion 334a also includes a
15 bulge portion 342a having a needle eye therein. The first terminal 33a is fixedly and electrically connected to a printed circuit board by press-fitting the bulge portion 342a into a corresponding opening on the printed circuit board. The first terminal 33a and the second terminal 33b are somewhat similar, but the extension portion 333b extends horizontally and outward
20 from the other end 3323b of the retention portion 332b.

Referring to FIGS. 5-10, as the first and second terminals 33a and 33b are inserted into their corresponding terminal-receiving cavities 315, their retention members 3322a and 3322b functioning as barbs are interference fit into their corresponding grooves 3165. During such insertion, the
25 retention members 3322a and 3322b anchor or dig into the corresponding retaining surfaces 3168, as shown in FIG. 10, to retain the terminals 33a and 33b within the insulating housing 31. As also shown in FIG. 10, the retention portions 332a and 332b further include a pair of separate stabilizers 3324a and 3324b disposed at opposite side edges 336a and 336b and protruding therefrom laterally and respectively. The stabilizers 3324a
30 and 3324b are behind the retention members 3322a and 3322b in the terminal insertion direction. After insertion of the terminals 33a and 33b,

the stabilizers 3324a and 3324b are received within the corresponding deep groove parts 31651. The stabilizers 3324a and 3324b are configured for preventing the inserted terminals 33a and 33b from moving laterally. Ideally, the stabilizers 3324a and 3324b extend laterally until the side surfaces 3325a and 3325b abut against the corresponding stabilizing surfaces 3169. However, due to the dimensional variations for molded articles, some stabilizers 3324a and 3324b may not contact their corresponding stabilizing surfaces 3169. In order to handle the variation problem, the stabilizers 3324a and 3324b may be designed to fit easily into, and firmly within, the stabilizing surfaces 3169 preferably with a slight interference.

Referring back to FIG. 7, because the extension portion 333a of the first terminals 33a and the extension portion 333b of the second terminals 33b extend in opposite directions, the support sections 3341a of the first terminals 33a reside in the corresponding inner recesses 3161, yet the support sections 3341b of the second terminals 33b reside in the corresponding outer recesses 3163. The first terminals 33a and the second terminals 33b are in an alternate arrangement so that the connection portion 334a and 334b thereof are in a zigzag arrangement along the lengthwise direction and the widthwise direction of the insulating housing 31.

Referring to FIG. 5 and FIGS. 11-14, the retention portion 332a of the first terminal 33a comprises at least one corresponding thinned-down section 335a, which is disposed adjacent to a corresponding side edge 336a of the retention portion 332a. The thinned-down section 335a may be disposed on only one surface 337a, facing toward the rib 317, of the retention portion 332a as shown in FIG. 11 and FIG. 13. In the present embodiment, the retention portion 332a comprises two thinned-down sections 335a. The two thinned-down sections 335a can be separated from each other. They may be substantially identical. They may also be aligned with each other transversely relative to the elongation direction of the terminals 33a as shown in FIG. 11. Likewise, the retention portion 332b of

each second terminal 33b comprises at least one respective thinned-down section 335b, which is disposed adjacent to the side edge 336b of the retention portion 332b. The thinned-down section 335b may be disposed on only one surface 337b, facing toward the rib 317, of the retention portion 332b as shown in FIG. 11 and FIG. 13. In the present embodiment, the retention portion 332b comprises two thinned-down sections 335b. The two thinned-down sections 335b can be separated from each other. They may be substantially identical. They may also be aligned with each other transversely relative to the elongation direction of the terminals 33b as shown in FIG. 11.

Referring to FIG. 12, the thickness of the thinned-down sections 335a and 335b, according to the present embodiment, can be varied only along the insertion direction (as shown by arrow 12) of terminals 33a and 33b. Namely, in the reverse direction relative to the insertion direction of terminals 33a and 33b, the thinned-down sections 335a and 335b are tapered down to a predetermined thickness in a short distance and the thickness is substantially retained throughout the remaining part of the thinned-down sections 335a and 335b (or to the peripheral extent thereof), yet the widthwise (transverse to the insertion direction) thickness of the thinned-down sections 335a and 335b is substantially constant. In accordance with the change in thickness, the thinned-down sections 335a, for example, are delimited by two sharp recessed edges 340a and 341a but smoothly and continuously connect to an unrecessed part 338a of the retention portion 332a using a tapered part 339a. Due to the thinned-down sections 335a and 335b, the retention portions 332a and 332b have less contact surface so as to reduce the required insertion force.

The retention members 3322a of the thinned-down sections 335a protrude from their corresponding side edges 336a of the terminals 33a. Likewise, the retention members 3322b of the thinned-down sections 335b protrude from their corresponding side edges 336b of the terminals 33b. Due to their thinner profile, they require less insertion force and are more

flexible so as to prevent the insulating housing from cracking or warping during terminal insertion.

5 In summary, prior art terminals will cause damage to an insulating housing which suffers from manufacturing variations, whereas the thinned-down section, disclosed herein, provided on a terminal can significantly reduce the possibility of damage to the insulating housing. The thinned-down feature not only can accommodate the insulating housing manufacturing variations, but also can also significantly reduce the force required to insert terminals into the insulating housing. The retention
10 member of the thinned-down section with less thickness requires less insertion force. The retention member becomes more flexible so as to prevent the insulating housing from cracking or warping during terminal insertion. In addition, terminal retention can be improved due to the elimination of housing cracks.

15 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 card edge connector for connecting a printed circuit board and a card module having a plurality of contact pads disposed on a mate edge thereof, the card edge connector comprising:

5 an insulating housing mounted on the printed circuit board, the insulating housing comprising:

a card edge receptacle for receiving the mate edge;

a plurality of terminal-receiving cavities arrayed along the insulating housing;

10 a plurality of transverse walls disposed along the insulating housing and corresponding to the terminal-receiving cavities; and

a plurality of retaining surfaces disposed and corresponding to the terminal-receiving cavities;

15 wherein each transverse wall spans the insulating housing, each terminal-receiving cavity is separated from adjacent terminal-receiving cavities in a direction along the insulating housing by the corresponding transverse walls, and each terminal-receiving cavity is provided with the corresponding retaining surface disposed on one of the adjacent transverse walls; and

20 a plurality of terminals, each terminal is received in the corresponding terminal-receiving cavity and configured for electrically interconnecting the contact pads and the printed circuit board, each terminal comprising:

25 a retention portion including at least one thinned-down section disposed and corresponding to the retaining surface, wherein each thinned-down section includes a retention member laterally protruding beyond a side edge of the retention portion to engage the corresponding retaining surface.

2. The card edge connector of Claim 1, wherein each terminal-

receiving cavity is further provided with a stabilizing surface disposed on one wall surface of the adjacent transverse walls, the retention portion further comprises a stabilizer extending laterally from the side edge corresponding to the stabilizing surface, and a side surface of the stabilizer
5 abuts against the stabilizing surface.

3. The card edge connector of Claim 1, wherein each terminal-receiving cavity is further provided with a stabilizing surface disposed on one wall surface of the adjacent transverse walls, the retention portion further comprises a stabilizer extending laterally from the side edge
10 corresponding to the stabilizing surface, and the stabilizer is interference fit into the stabilizing surface.

4. The card edge connector of Claims 2 or 3, wherein the stabilizer is behind the retention member in an insertion direction of the terminals.

5. The card edge connector of Claims 2 or 3, wherein each terminal-receiving cavity is provided with a two-stepped groove having a deep groove part and a shallow groove part, wherein the stabilizing surface is disposed within the deep groove part and the retaining surface is disposed within the shallow groove part.
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6. The card edge connector of Claim 1, wherein the thinned-down section is tapered down to a predetermined thickness in a short distance and remains at the predetermined thickness to a peripheral extent in a reverse direction relative to an insertion direction of the terminals.
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7. The card edge connector of Claim 1, wherein the plurality of terminal-receiving cavities are arrayed in two rows along the insulating housing, and two rows of the terminal-receiving cavities are spaced apart from one another to define the card edge receptacle therebetween.
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8. The card edge connector of Claim 7, wherein the plurality of terminals comprise a plurality of the first and second terminals, and each of the first and second terminals further comprises:

5 a contact portion which projects vertically and inwardly from one end of the retention portion and is configured to engage the corresponding contact pad;

an extension portion horizontally extending from the other end of the retention portion; and

10 a connection portion extending downward from one end of the extension portion;

wherein the extension portion of the first terminal and the extension portion of the second terminal extend in opposite directions.

9. The card edge connector of Claim 8, wherein each connection portion of the first and second terminals further comprises a support section,
15 a bottom edge of each transverse wall comprises an outer recess and an inner recess which is closer to the reinforcing rib than the outer recess, the support section of the first terminal resides in the corresponding inner recess, and the support section of the second terminal resides in the corresponding outer recess.

20 10. The card edge connector of Claim 1, wherein the at least one thinned-down section comprises a pair of thinned-down sections disposed adjacent to the opposite side edges of the retention portion respectively and aligned with each other transversely relative to an elongation direction of the terminals, and each terminal-receiving cavity is provided with a pair of
25 retaining surfaces disposed on the opposite facing transverse walls, wherein each thinned-down section includes a retention member laterally protruding beyond the corresponding side edge of the retention portion to engage the corresponding retaining surface.

11. The card edge connector of Claim 10, wherein each terminal-

receiving cavity is further provided with a pair of stabilizing surfaces disposed on the opposite facing wall surfaces of the transverse walls respectively, the retention portion further comprises a pair of stabilizers extending laterally from the respective side edges, and side surfaces of the stabilizers abut against the corresponding stabilizing surfaces.

12. The card edge connector of Claim 10, wherein each terminal-receiving cavity is further provided with a pair of stabilizing surfaces disposed on the opposite facing wall surfaces of the transverse walls respectively, the retention portion further comprises a pair of stabilizers extending laterally from the respective side edges, and the stabilizers are interference fit into the corresponding stabilizing surfaces.