

CARD EDGE CONNECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 The present invention relates to a card edge connector, and more particularly, to a card edge connector having a combined ejecting and latching mechanism for ejecting and latching a card with a height greater than that of the cards of standard form.

2. Description of the Related Art

10 Printed circuit boards, generally providing limited functions, are installed with a plurality of card edge connectors for receiving different types of printed circuit cards having various functionalities to expand their capabilities. Usually, the printed circuit cards for the card edge connectors are removable, and to remove these cards smoothly, ejection mechanisms are offered for the card edge connectors to remove inserted printed circuit
15 cards.

For example, in a computer system, a memory module is one of the most familiar printed circuit cards for most people. To eject a memory module, many ejection mechanisms have been developed. Traditionally, a lever arm has been applied for the card ejecting operation. However,
20 normally the lever arm is close to a mother board so that it is difficult to operate, and it requires more space for its rotary operation. Therefore its use is not compatible with modern compact design.

To overcome the aforementioned drawback, several card ejection mechanisms have been presented, such as the disclosures in U.S. Pat. No. 5,571,025 by Arai et al., U.S. Pat. No. 5,577,922 by Enomoto et al., and U.S.
25 Pat. No. 5,660,552 by Suzuki et al. Each of the above-mentioned patents discloses a similar card ejection mechanism that includes a push bar and a rotatable member engageable with the push bar and the received edge of a

printed circuit card. The push bar transmits a force on one end of the rotatable member, causing the rotatable member to rotate, and the other end of the rotated rotatable member engages and pushes the received edge of a printed circuit card until the printed circuit card is ejected. Usually, a received printed circuit card is firmly clamped to prevent accidental removal, and the received printed circuit card normally has to be moved a certain distance to be ejected completely. Thus, to completely eject a received printed circuit card, the rotatable member has to be large enough to generate sufficient levering force for smoothly ejecting operation and has to be able to rotate a certain angle to move the received printed circuit board beyond that certain distance. Consequently, the card edge connector requires a large space for accommodating a rotatable member with a considerable size so as to cause the card edge connector to become thicker and to increase the electrical paths of terminals.

In addition, in the card edge connectors disclosed in the above-mentioned patents, a received printed circuit board is mainly latched by a latch mechanism, which is operated independently from the push bar and the rotatable member. To eject a received printed circuit card, extra force is required to disengage the latch mechanism from the notch or cutout of the received printed circuit card before or during card ejection operation. Thus, operating a latch mechanism and a push bar independently is likely to cause unintentional damage, and such extra force requirement is inconvenient as well.

Moreover, U.S. Pat. No. 5,571,025 by Arai et al. further discloses a push bar including a card retaining arm that can engage a cutout and retain the card in the connector. The card retaining arm is tilted to disengage from the respective cutout by interaction of a set of lugs disposed on the push bar and a groove in a guide post receiving the push bar. Such a mechanism is complex and not easy to assemble.

Furthermore, the ejection mechanisms of the above-mentioned patents are designed for a memory module conforming to a standard full-sized form

factor, and they may not be compatible with a memory module with a height larger than that of a standard memory module.

In light of the above-mentioned problems, the ejection mechanism of conventional card edge connectors has some drawbacks, and therefore a new card edge connector, which can be easily and safely operated and adapted for standard or non-standard card modules, is required.

SUMMARY OF THE INVENTION

An objective of the present invention is to provide a new and improved card edge connector that can easily and safely eject an inserted card and can adapt to standard or non-standard card modules.

In order to achieve the above objective, a card edge connector for receiving a printed circuit card having a plurality of notches on opposite side edge portions respectively and an insertion edge portion along which a plurality of contact pads are provided is disclosed according to one embodiment of the present invention. The card edge connector comprises an insulating housing, a plurality of conductive terminals, a latch-ejector assembly and an actuator. The insulating housing comprises opposite end portions and a card-receiving slot disposed between the end portions. The conductive terminals are provided within the insulating housing and have contact portions for engaging the contact pads on the printed circuit card. The latch-ejector assembly is able to move in a pivoting manner within each end portion, and comprises a front side, a latch portion, an ejector portion and an arm portion. The front side faces toward the card-receiving slot. The latch portion is formed on the front side and is configured for holding the printed circuit card inserted in the card-receiving slot. The ejector portion projects from the front side and is configured for engaging the leading edge of the insertion edge portion of the printed circuit card to eject the printed circuit card from the card-receiving slot in response to pivoting the latch-ejector assembly. The arm portion extends away from the front side. The actuator includes a push member, which is movable within each

end portion and is configured for engaging the arm portion of the latch-ejector assembly to pivot the latch-ejector assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. 1 illustrates a card edge connector and a printed circuit card according to one embodiment of the present invention;

FIG. 2 illustrates a card edge connector according to one embodiment of the present invention;

10 FIG. 3 is a perspective exploded view of FIG. 2;

FIG. 4 is an enlarged perspective view showing the bottom of the end portion of an insulating housing according to one embodiment of the present invention;

15 FIG. 5 is a perspective view of a latch-ejector assembly according to one embodiment of the present invention;

FIG. 6 is another perspective view of the latch-ejector assembly of FIG. 5;

FIG. 7 is a perspective top view of the end portion of an insulating housing according to one embodiment of the present invention;

20 FIG. 8 is a perspective partially side cut view showing the end portion of an insulating housing according to one embodiment of the present invention;

25 FIG. 9 is a perspective view showing the locating shafts and the push member of an actuator according to one embodiment of the present invention;

FIG. 10 is another perspective view showing the locating shafts and the push member of an actuator according to one embodiment of the present invention;

FIG. 11 is a perspective partially side cut view showing the engagement between locating shafts and shaft receiving grooves according to one embodiment of the present invention;

FIG. 12 is a perspective view showing an actuator according to one embodiment of the present invention;

FIG. 13 is a front view of an actuator according to one embodiment of the present invention;

FIG. 14 is an enlarged perspective side cut view showing the engagement of an actuator, a latch-ejector assembly, and a printed circuit card according to one embodiment of the present invention;

FIG. 15 is a side cut view showing the engagement of an actuator, a latch-ejector assembly in an unlock position, and a printed circuit card according to one embodiment of the present invention;

FIG. 16 illustrates a card edge connector and an inserted printed circuit card according to one embodiment of the present invention; and

FIG. 17 is a side cut view showing the engagement of an actuator, a latch-ejector assembly in a lock position, and a printed circuit card according to one embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, embodiments of the card edge connector having an ejection mechanism of the present invention will be described in detail with reference to the attached drawings. As illustrated in FIGS. 1 and 2, the card edge connector 1, mounted on a printed circuit board 2, is configured to receive a printed circuit card 3 vertically oriented. The printed circuit card

3, inserted between two actuators 11 for card ejection operation, may comprise an insertion edge portion 31 and a plurality of contact pads 32 spaced along the insertion edge portion 31. The printed circuit card 3 may further comprise a plurality of notches 33 separately disposed on the
5 respective side edge portions 34 of the printed circuit card 3. In the present embodiment, the printed circuit card 3 may include, for example, a memory card module such as double data rate synchronous DRAM (DDR SDRAM, DDR2 SDRAM, and DDR3 SDRAM), and the printed circuit card 3 may conform to the standard full-sized card dimension or may have a height
10 greater than the standard height. To make the card edge connector 1 of the present invention eject a printed circuit card 3 with a height greater than the standard height smoothly, two actuators 11 having heights approximately equivalent to the height of the printed circuit card 3 are vertically and supportably disposed adjacent to the respective side edge portions 34 so that
15 users can easily access and use the actuators 11 to eject a received printed circuit card 3.

Referring to FIG. 2, the card edge connector 1 comprises an elongated insulating housing 12 having two oppositely disposed end portions 121 and a card-receiving slot 122 facing upward, extending between the two end
20 portions 121 of the insulating housing 12, and configured for receiving the insertion edge portion 31 of a printed circuit card 3. Each end portion 121 has a hollow interior, in which a latch-ejector assembly 13 is provided. Above the latch-ejector assembly 13, an actuator 11 is supportably mounted to the respective end portion 121.

Referring to FIGS. 1, 3 and 4, within the insulating housing 12, a plurality of cavities configured to receive conductive terminals 14 are arrayed on opposite sides of the card-receiving slot 122. Each terminal 14 includes a contact portion 141, which can protrude into the card-receiving
25 slot 122 for engaging the contact pad of a printed circuit card 3, and a tail portion 142 that can project downward and outward relative to the insulating housing 12 to form a surface-mount configuration mountable on
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pads on a printed circuit board 2, as shown in FIG. 4, to connect to the circuitry on the printed circuit board. Alternatively, each terminal 14 may include a tail portion 142 that can project downward and beyond the insulating housing 12 to form a through-hole pin configuration insertable
5 into a respective hole on a printed circuit board 2. Each end portion 121 is peripherally defined by two opposite side walls 1211, two inside walls 1212 disposed side by side, and one end wall 1213. The two inside walls 1212 are separated by a slot 123, which is connected to the card-receiving slot 122 and is sufficiently wide to receive the respective side edge portion 34 of
10 an inserted printed circuit card 3 as shown in FIG. 1.

Referring to FIG. 3, the card edge connector 1 is adapted for permanent mounting on a printed circuit board 2 as shown in FIG. 1. To this end, a plurality of positioning members 15 and hold-down members 16 are provided. Referring to FIG. 4, a positioning member 15 and a hold-down
15 member 16 are firmly attached to the respective end portion 121. Each positioning member 15 has a head portion received in a cavity 1214 in the end portion 121 and a leg portion configured to project beyond the bottom of the end portion 121, for insertion into an appropriate hole in a printed circuit board 2 for positioning.

Referring to FIG. 4, each hold-down member 16 has a hook portion 161 and a planar portion 162, the bottom surface of which can be soldered onto the printed circuit board 2. With respect to the hold-down member 16, an indented surface 1215 is formed on the bottom of the end portion 121 and a transverse hooking bar 1216 is formed close to the bottom of the end
20 portion 121. When the hold-down member 16 is assembled, the hook portion 161 engages the hooking bar 1216 in a hooking manner and the planar portion 162 rests upon the indented surface 1215.
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FIGS. 5 and 6 show one of the latch-ejector assemblies 13 in greater detail. The latch-ejector assembly 13, movable in a pivoting manner within
30 the respective end portion 121, is configured to latch or lock an inserted printed circuit card 3 to prevent the inserted printed circuit card 3 from

being accidentally pulled out and to smoothly eject an inserted printed circuit card in a pivoting manner. To this end, the latch-ejector assembly 13 comprises a front side 131, a latch portion 132, an ejector portion 133, and an arm portion 134. The front side 131 facing the card-receiving slot 122 in
5 FIG. 3 or the respective side edge of an inserted printed circuit card 3 includes two opposite edges, the bottom edge 1311 and the upper edge 1312. The ejector portion 133 projecting from the front side 131 and adjacent to the bottom edge 1311 of the front side 131 is configured to engage the leading edge of the insertion edge portion 31 of an inserted printed circuit
10 card 3 at a location proximate to a respective corner partially defined by the leading edge of the insertion edge portion 31 to eject the printed circuit card 3 from the card-receiving slot 122 in response to force applied to the latch-ejector assembly 13. The latch portion 132 configured to hold the printed circuit card 3 inserted into the card-receiving slot 122 is disposed adjacent
15 to the upper edge 1312 of the front side 131. The arm portion 134 extends away from the front side 131 and is configured to rotate the latch-ejector assembly 13 to eject an inserted printed circuit card 3.

More specifically, the latch-ejector assembly 13 includes a groove 135 formed on the front side 131 and defined by the latch portion 132, the
20 ejector portion 133, and two side walls 136. The transverse span of the groove 135 is larger than the thickness of a printed circuit card 3 such that the ejector portion 133 can move along the leading edge of the insertion edge portion 31 of a printed circuit card 3 during card insertion or ejection without obstruction by the section around the respective corner defined by
25 the edges of the insertion edge portion 31 and the respective side edge portions 34 of the printed circuit card 3. The ejector portion 133 extrudes from the front side 131 with formation of corner edges 1331 between the side edges of the ejector portion 133 and the front side 131. The corner edges 1331 can be chamfered to enhance the strength of the ejector portion
30 133. Referring to FIG. 6, the back surface 1332 of the ejector portion 133 is indented and two radius corners 1333 are respectively formed at the boundaries between inner surfaces of the side walls 136 and the back

surface 1332 to enhance the strength of the ejector portion 133 as well.

Referring to FIGS. 5 and 6, two pivot portions 137 are formed on the outside peripheral surfaces of the respective side walls 136. On each side wall 136, a bump portion 138 is formed to confine the movement of the latch-ejector assembly 13. Each bump portion 138 has two inclined surfaces 1381 oppositely disposed, with one of them facing toward the card-receiving slot 122 of the card edge connector 1. The arm portion 134 can have a substantially uniform width smaller than the length of the upper edge 1312 or the bottom edge 1311. The arm portion 134 can also include an enlarged base section and be tapered therefrom to a reduced distal end portion 1342, and an upper surface 1341 defining the arm portion 134 can join the peripheral surface of the latch portion 132. As best seen in FIG. 17, the distal end portion 1342 of the arm portion 134 can extend perpendicularly to the front side 131 such that when the latch-ejector assembly 13 is moved upright to the "lock" position, the distal end portion 1342 can be substantially horizontal. Such the configuration of the distal end portion 1342 can provide a larger leverage with shorter the length of the latch-ejector assembly 13.

Referring to FIGS. 5 to 8, each end portion 121 is peripherally defined by two opposite side walls 1211, two inside walls 1212 disposed side by side, and one end wall 1213; and a plurality of cavities are formed inside. As shown in FIG. 8, on each side wall 1211, a pivot hole 12111 is formed to receive the respective pivot portion 137 so that the latch-ejector assembly 13 can rotate relative to the pivot portions 137 within the end portion 121. Referring to FIGS. 5 and 8, a depressed section 12114 formed on the inside surface of each side wall 1211 extends from the top surface of the side wall 1211 to the pivot hole 12111 for temporary retention of the respective bump portion 138 so as to confine the forward and backward movement of the latch-ejector assembly 13 when the bump portions 138 reside within the respective depressed sections 12114.

Referring to FIGS 8 to 11, actuators 11 are used to rotate the respective

latch-ejector assemblies 13 within the end portions 121 to eject an inserted printed circuit card 3. Each actuator 11 includes a supporting portion 111 configured to rest upon the top of the respective end portion 121 to support the actuator 11 when no printed circuit card is inserted. The supporting
5 portion 111 can have a pair of front bottom surfaces 1111 disposed with respect to and engageable with the top edge surface of the respective side wall 1211 of the end portion 121, and a pair of rear bottom surfaces 1112 disposed with respect to and engageable with the top edge surface of the respective end wall 1213 of the end portion 121. With the help of the front
10 bottom surfaces 1111 and the rear bottom surfaces 1112, each actuator 11 can be prevented from moving downward beyond a lowest position thereof and from toppling inward or outward when the latch-ejector assembly 13 is in an unlocked position.

Referring to FIGS. 8, 9 and 10, two locating shafts 113 extend outward
15 from the side of disposition of the bottom surfaces 1111 of the supporting portion 111 and a push member 114, with an end surface 1141 engageable with the distal end portion 1342 of the arm portion 134, is formed between the locating shaft 113. Correspondingly, a shaft receiving groove 12112 is formed on the inside surface of each side wall 1211 of the end portion 121
20 to provide guidance for the respective sliding locating shaft 113 as shown in FIG. 8. On the bottom surface of the shaft receiving groove 12112, an indented section 12113 is provided. Each locating shaft 113 includes a side bump 1131 extending laterally and corresponding to the respective indented section 12113. Referring to FIG. 11, when the actuator 11 is assembled to
25 the end portion 121, each side bump 1131 enters into the respective indented section 12113 such that the actuator 11 is only allowed to move within the vertical extent of the indented sections 12113.

Referring to FIGS. 8 and 10, on the inner side surface of the end wall 1213 of the end portion 121, three parallel elongated grooves 12131 are
30 formed along the moving direction of the actuator 11. Correspondingly, an elongated protruding member 112 and two side protruding blocks 1132 are

formed on the actuator 11. The elongated protruding member 112 movable within the central elongated groove 12131 is formed on the side, facing the end wall 1213, of the push member 114; and two side protruding blocks 1132 protrude from the respective sliding locating shafts 113 and are disposed with respect to and movable within the two respective side elongated grooves 12131. The combination of the elongated protruding member 112 and the central parallel elongated grooves 12131, and the combinations of the two side protruding blocks 1132 and the side parallel elongated grooves 12131, provide guidance for the movement of the actuator 11. Further, the interaction of the elongated protruding member 112 and the central parallel elongated grooves 12131 may prevent each actuator 11 from incorrect orientation for its installation.

Referring to FIGS. 12 and 13, each actuator 11 further comprises a body portion 115 and a head portion 116 supported by the body portion 115, for engagement by an operator's finger or thumb. The body portion 115 can have a slim shape so as to facilitate air flow around the body portion 115 and to increase the heat dissipation of an inserted printed circuit card 3. A slot 117 is provided along the inner side of the body portion 115. The slot 117 is configured to allow the respective side edge portion 34 of an inserting printed circuit card 3 to slide therein for guidance. The head portion 116 can have a slope surface 1161 facing upward and slightly away from the card edge connector such that the actuator 11 can be pushed toward the card edge connector 1 when a printed circuit card 3 is being ejected. In one embodiment, each actuator 11 can be molded of plastic material. In another embodiment, a metal rib can be insert-molded into every actuator 11 such that a heavier actuator 11 can be obtained for different applications.

Referring to FIGS. 1, 14 and 15, when a printed circuit board 3 is to be inserted into a card edge connector 1, the side edge portions 34 of the printed circuit card 3 are initially inserted into the slots 117 of the respective actuators 11 and the printed circuit card 3 is moved toward the

card edge connector 1 until the insertion edge portion 31 reaches the card-receiving slot 122. Next, the printed circuit card 3 is pushed toward the card edge connector 1. Before the printed circuit card 3 is inserted, each latch-ejector assembly 13 is in an "unlock" position. Specifically, each
5 latch-ejector assembly 13 is inclined with the ejector portion 133 positioned into the card-receiving slot 122 and ready for engagement with the leading edge of the insertion edge portion 31. When the printed circuit card 3 is being inserted, the leading edge of the insertion edge portion 31 of the printed circuit card 3 occasionally engages the ejector portion 133 such that
10 the insertion edge portion 31 of the printed circuit card 3 pushes the ejector portion 133 to rotate the latch-ejector assembly 13 in the direction of arrow "A" shown in FIG. 15. During rotation, the arm portion 134 of the latch-ejector assembly 13 engages the push member 114 and moves the actuator 11 upward until the latch portion 132 engages the corresponding notch 33
15 of the printed circuit card 3 or the latch-ejector assembly 13 is in a "lock" position as shown in FIGS. 16 and 17. As clearly seen in FIG. 14, during insertion, a corner of the insertion edge portion 31 is free to move within the groove 135 of the latch-ejector assembly 13.

As shown in FIG 17, when an inserted printed circuit card 3 is to be
20 ejected, a force is applied on the head portion 116 of the actuator 11 with the push member 114 engaging the arm portion 134 of the latch-ejector assembly 13. The push member 114 pushes the arm portion 134 of the latch-ejector assembly 13 to rotate the latch-ejector assembly 13 in a direction opposite to the direction of arrow "A." When the latch-ejector
25 assembly 13 starts to rotate, the latch portion 132 disengages from the respective notch 33 such that the latch portion 132 has no engagement with the printed circuit card 3 and no extra force is required. During rotation, the ejector portion 133 of the latch-ejector assembly 13 engages the leading edge of the insertion edge portion 31 of the printed circuit card 3 and moves
30 the printed circuit card 3 in a direction away from the card-receiving slot 122 until the printed circuit card 3 is completely ejected as shown in FIG 15. Finally, the printed circuit card 3 can be taken out along the slots 117 of the

actuator 11.

In summary, the card edge connector of the present invention comprises an actuator having a height tall enough to allow a user to easily eject a tall card without access problems. The card edge connector further
5 comprises a latch-ejector assembly configured to move in a pivoting manner to secure and eject a printed circuit card and to be rotated by the actuator when a printed circuit card is to be ejected. The latch-ejector assembly comprises a front side, a latch portion, an ejector portion, and an arm portion. The ejector portion projecting from the front side is configured to
10 eject a printed circuit card. The latch portion configured to hold the printed circuit card inserted into the card-receiving slot is formed on the front side. The arm portion extending away from the front side is configured to rotate the latch-ejector assembly to eject an inserted printed circuit card.

The above-described embodiments of the present invention are
15 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 receiving a printed circuit card having a plurality of notches on opposite side edge portions respectively and an insertion edge portion along which a plurality of contact pads are provided, the card edge connector comprising:

an insulating housing comprising opposite end portions and a card-receiving slot between the end portions;

a plurality of conductive terminals provided within the insulating housing and having contact portions for engaging the contact pads on the printed circuit card; and

a latch-ejector assembly movable in a pivoting manner within each end portion, the latch-ejector assembly comprising:

a front side facing toward the card-receiving slot;

a latch portion formed on the front side and adjacent to an upper edge of the front side, the latch portion configured for holding the printed circuit card inserted in the card-receiving slot;

an ejector portion formed on the front side and adjacent to a bottom edge of the front side, the ejection portion configured for engaging the leading edge of the insertion edge portion of the printed circuit card to eject the printed circuit card from the card-receiving slot in response to pivoting the latch-ejector assembly; and

an arm portion extending away from the front side; and

an actuator having a push member movable within each end portion and configured for engaging the arm portion of the latch-ejector assembly to pivot the latch-ejector assembly.

2. The card edge connector of Claim 1, wherein each actuator further comprises a supporting portion engageable with the top edge surface of the respective end portion for preventing the actuator from moving downward.

3. The card edge connector of Claim 2, wherein the actuator comprises a body portion having a slim shape and a head portion supported by the body portion, for engagement by an operator's finger or thumb.

4. The card edge connector of Claim 3, wherein each actuator further comprises two locating shafts disposed on opposite sides of the push member; and each end portion includes opposite side walls defining the end portion, and shaft receiving grooves are formed on the respective side walls, wherein each of the shaft receiving grooves provides guidance for the respective locating shaft when the actuator moves.

5. The card edge connector of Claim 4, wherein each locating shaft further comprises a side bump and each shaft receiving groove includes an indented section, wherein each side bump is confined and allowed to move within the respective indented section when the actuator is assembled into the respective end portion.

6. The card edge connector of Claim 5, wherein each end portion includes an end wall having an elongated groove, and each actuator further comprises an elongated protruding member disposed with respect to the elongated groove, wherein the interaction of the elongated groove and the elongated protruding member provides guidance for the movement of the actuator and prevents the actuator from incorrect installation.

7. The card edge connector of any one of Claims 1 to 5, wherein a distal end portion of the arm portion extends substantially perpendicular to the front side.

8. The card edge connector of Claim 7, wherein the latch-ejector assembly further comprises a groove formed on the front side, and the groove is of a size to allow a respective corner of the printed circuit card to move freely when the printed circuit card is being inserted or ejected.

9. The card edge connector of Claim 8, wherein the latch-ejector assembly further comprises two side walls defining the groove and two pivot portions respectively formed on the side walls for providing pivotal motion of the latch-ejector assembly.

5 10. The card edge connector of Claim 9 wherein the latch-ejector assembly further comprises bump portions formed on the respective side walls of the latch-ejector assembly for confining the movement of the latch-ejector assembly.

10 11. The card edge connector of Claim 3, wherein the head portion includes a slope surface facing upward and slightly away from the insulating housing.