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IC PACK CONNECTOR WITH DETECT SWITCHField of the Invention

This invention generally relates to the art of electrical connectors and, particularly, to a connector assembly which provides an interconnection between an IC pack and a printed circuit board and, further, to such a connector assembly which includes a switch actuatable in direct response to insertion of an IC pack thereinto.

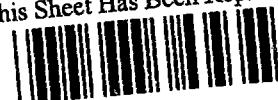
Background of the Invention

A conventional connector assembly for an IC pack or memory card comprises a generally U-shaped connector having guide grooves inside a pair of guide portions, with a bight portion joining or extending between the side portions. A planar IC pack is inserted into the connector assembly between the guide portions. A transverse array of socket terminals at an edge of the IC pack electrically interconnect with an associated array of pin terminals on the bight portion.

Such connector assemblies often are provided as header connectors used for interconnecting the semiconductor circuit of the IC pack to an external circuit such as a main electronic unit. The header may be used with an IC pack or memory card for removably coupling the IC pack to a printed circuit board. The IC pack is inserted into the header and is extracted therefrom as needed.

One of the problems with IC pack connector assemblies of the character described above, particularly in headers employed with printed circuit boards, is that

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the insertion or extraction of the IC packs with respect to the connectors can interfere with ongoing processes or interrupt data transfer, for example, between the IC pack and the main electronic unit. Furthermore, a program or a user may not be alerted to the fact that an IC pack or memory card is not present which is needed for certain processes.

Switches have been designed into connectors for the purpose of detecting the presence of an IC pack or memory card. Several such designs have been incorporated into card readers, such as are disclosed in U.S. Patent Nos. 4,900,272, 4,900,273 and 5,013,255. These designs use an "end of stroke" contact to detect the position and/or full insertion of the card within the connector. However, such designs are not easily adaptable to pin and socket type memory card interfaces such as is defined by the Personal Computer Memory Card International Association ("PCMCIA") standards. In the card reader connectors of the prior art, the "end-of-stroke" contact is positioned at the rear of the card slot. This is practical in such connectors because it does not interfere with the mating contact interface, since the card reader contacts are typically mounted in the base of the connector housing and the forces are exerted on the card perpendicular to the direction of insertion. However, in pin and socket type cards, where the mating contact interface is at the rear of the card slot, and the forces exerted between the mating contacts are along the direction of insertion, this type of "end-of-stroke" contact is impractical. First, the "end-of-stroke" contact at the rear of the card slot would interfere with and/or be obstructed by the mating contact interface, and, second the forces exerted by the "end-of-stroke" contact would increase the insertion forces of the card itself, opposing the frictional force of the contacts.

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Accordingly, such a structure is not useful for PCMCIA-type applications.

Another design for detecting the insertion and/or extraction of an IC pack or memory card within a card slot is disclosed in U.S. Patent 5,330,363 and assigned to the assignee of this invention. However, the switch design as disclosed is for use with a card ejecting mechanism wherein the movement of the actuator or push rod closes the switch in response to the movement of the card.

Applicants' invention is directed to a connector assembly having a switch mounted in a portion thereof wherein the switch is actuated in direct response to the insertion of an IC pack into the connector assembly. Therefore, the switch can be used to shut down various processes upon insertion of the IC pack into the connector assembly and to otherwise detect the presence of an IC pack and alert a user of the same. The switch is located along the path of insertion of the IC pack so that standard IC packs and/or the interface between the packs and the connector do not have to be modified.

Summary of the Invention

An object, therefore, of the invention is to provide a new and improved connector assembly for providing an interconnection between an IC pack or memory card and an electronic unit, such as a printed circuit board, and including a switch in the connector assembly.

In the exemplary embodiment of the invention, the connector assembly is illustrated for interconnection between an IC pack and a printed circuit board. The connector assembly comprises a U-shaped header connector for mounting on the printed circuit board. A pair of guide arms define a pathway into which the IC pack is inserted and from which it is ejected. A plurality of pin terminals



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are mounted in a bight portion of the header connector and are adapted for interconnection of the IC pack to electrical traces on the printed circuit board. The invention contemplates that an electrical switch be provided on the guide arms of the header connector in such a manner that the switch is actuated in direct response to insertion of the IC pack by the IC pack itself. The switch is interconnected to electrical traces on the printed circuit board.

In the preferred embodiment of the invention, the electrical switch is provided by way of a pair of spaced-apart contacts one of which is mounted in the pathway of insertion of the IC pack, whereby the contacts are closed during insertion of the IC pack into the header connector. The movement of the one contact is in a direction normal to the direction of insertion of the IC pack into the connector assemblies.

Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

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Brief Description of the Drawings

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

10 FIGURE 1 is a perspective view of the connector of the invention mounted to a printed circuit board, and an IC pack for insertion into the connector;

FIGURE 2 is an enlarged perspective view of the connector mounted to the printed circuit board;

15 FIGURE 3 is a further enlarged perspective view of the switch on the connector;

FIGURE 4A and 4B are perspective views of the contacts of the switch removed from the connector;

20 FIGURE 5 is a top plan view of the switch in its open condition, prior to insertion of the IC pack; and

FIGURE 6 is a view similar to that of Figure 5, with the IC pack inserted and moved to a position of closing the switch.

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Detailed Description of the Preferred Embodiment

Referring to the drawings in greater detail, and first to Figure 1, the invention is embodied in a connector assembly in the form of a header connector, generally designated 12, for providing an interconnection between an IC pack 14 and a printed circuit board 16. The header is adapted for receiving the IC pack in the direction of arrow "A".

Referring to Figure 2 in conjunction with Figure 1, header 12 is of a generally known configuration and includes a generally U-shaped dielectric housing 18 defined by a pair of guide arms 20 joined by a connecting bight portion 22. The bight portion 22 mounts a plurality of terminals having pin portions 24 projecting generally parallel to the plane of the printed circuit board toward the IC pack. The terminals include tail portions (not shown) connected to circuit traces on the upper surface of printed circuit board 16, as by soldering. Guide arms 20 include guide grooves 28 on the inside thereof for defining an IC pack pathway and for guiding IC pack 14 into the header, whereby socket terminals (not shown) in forward edge 14a of the IC pack interengage with pin portions 24 of the terminals of the header. Lastly, an electrical switch 30 is provided on the header in the guide grooves 28 of guide arms 20, along the path of insertion of the IC pack, to be described in more detail hereinafter. Accordingly, the electrical switch is actuated in response to the insertion of IC pack 14 into the header 12.

In assembly, header 12 is mounted to printed circuit board 16 with the terminals of the header interconnected to circuit traces on the printed circuit board via soldering. An IC pack or memory card, such as IC pack 14, can then be inserted into and extracted from header 12 as needed.

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Referring to Figures 3 and 4 in conjunction with Figures 1 and 2, electrical switch 30 is embodied in a pair of electrical contacts, generally designated 32 and 34. The contacts are stamped and formed of sheet metal material and are mounted in dielectric housing 18 of header 12 such that contact portions 32a and 34a of contacts 32 and 34, respectively, are normally spaced-apart (Fig. 5). More particularly, contact 32 includes a generally U-shaped anchoring portion 32b (Fig. 4) for retention within a corresponding groove 36 in the header housing 18 (Fig. 3) which holds contact 32 securely within the header. Contact 32 further includes a foot portion 32c for soldering within a plated through hole or for surface mounting to a circuit trace on printed circuit board 16. Contact portion 32a is joined to anchoring portion 32b by a spring arm 32d so that the contact portion is movable in the direction of double-headed arrow "B", but the contact portion is biased toward its normally open position shown in Figures 3 and 5.

Contact 34 similarly includes an anchoring portion 34b for being retained within a groove 40 of the housing. Contact 34 also includes a foot portion 34c for soldering within a plated through hole or for surface mounting to a circuit trace on printed circuit board 16. Contact portion 34a is cantilevered upwardly from anchoring portion 34b and is spaced away from contact portion 32a of contact 32 in the normally open condition of the switch (Fig. 5). Therefore, contact portion 34a of contact 34 may be considered the fixed contact of switch 30 and contact portion 32a of contact 32 may be considered the movable contact of the switch.

Referring now to Figures 5 and 6, the location of switch 30 in relation to the IC pack 14 is illustrated. It can be seen in Figures 5 and 6 that movable contact portion 32a of contact 32 of electrical switch 30 is located in the

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path of insertion of IC pack 14. Movable contact portion 32a projects inwardly within the IC pack pathway defined by guide grooves 28 a sufficient distance to cause movable contact portion 32a to engage contact portion 34a of contact 34 during insertion of IC pack 14. That is to say, during insertion of the IC pack into header movable contact portion 32a moves in a direction normal to the insertion of the IC pack. Since only a portion of the force exerted against the movable contact is directly opposing the insertion force of the card, the switch can be incorporated within one or both of the guide grooves 28 without substantially effecting the insertion force of the IC pack. Contact portion 52a is sufficiently resilient to prevent any damage to the switch construction. In essence, it can be understood that the above-described construction of electrical switch 30, along with its location and that of actuation by the IC pack itself, forms a switch which is actuated by the IC pack itself, i.e. detects the insertion and presence of an IC pack within the IC pack pathway. Furthermore, the switch 30 may be positioned anywhere within guide grooves 28 along guide arm 20 to detect the presence of an IC pack at any point of travel along the IC pack pathway. For example, the switch could be positioned along groove 28 proximate the header pins 24, thus alerting a user that the IC card is positioned within the IC pack pathway, and electrically engaging the header pins.

Therefore, in operation, when an IC pack is inserted into header 12, such insertion of the IC pack causes movable contact 32a to move from the position shown in Figure 5 to the position shown in Figure 6 whereat the electrical switch is attached, i.e. the contacts are in their closed position (i.e. connecting the electrical circuit through the circuit traces on the printed circuit board interconnected to feet 32c and 34c of the contacts).

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Electrical switch 30 can be used for a variety of purposes, including a detection of the presence or absence of the IC pack during a desired operation to prevent interference with ongoing processes or data transfer which might be affected by the removal or insertion of the IC pack, or the warning or notice that an IC pack is required to be inserted to perform a requisite or desired function. Therefore, electrical switch 30 is located in the path of IC pack 14 so that the system may be shut-down or "notified" of the disengagement of terminals pins 24 from the terminal sockets of the IC pack, or, upon insertion of an IC pack, to open the switch and allow the system to operate and/or transfer data when the terminals have been fully interengaged.

Note that, depending on the location of the switch, the detection can be performed at any stage of the insertion of the IC pack. In addition, by having the switch actuated by the IC pack itself, the header can be used either with or without an ejector mechanism. Such a design allows for flexibility depending on the specific application.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

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CLAIMS

1. In a connector assembly for providing an interconnection between an IC pack (14) and a printed circuit board (16), comprising

5 a header connector (12) for mounting on the printed circuit board including a pair of guide arms (20) having guide grooves (28) defining a pathway into which the IC pack is inserted, and

10 a plurality of terminals (24) on the header connector located at the rear of the pathway and adapted for interconnection of the IC pack to electrical traces on the printed circuit board,

characterized in that:

15 an electrical switch (30) is mounted on the guide arms of the header connector, said switch being defined by a pair of spaced-apart contacts (32, 34) adapted to be closed in direct response to insertion of the IC pack into the header connector,

20 wherein one (32) of the pair of spaced-apart contacts (32, 34) includes a movable contact portion (32a) located along the pathway of the IC pack movable by a portion of the IC pack during insertion thereof into the header connector.

25 2. In a connector assembly as set forth in claim 1, wherein said movable contact portion of the electrical switch moves in a direction normal to the direction of insertion of the IC pack, and the other (34) of the pair of spaced-apart contacts (32, 34) remains fixed.

30 3. A connector assembly for providing an interconnection between an IC pack (14) and a printed circuit board (16), characterized by:



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a U-shaped header connector (12) for mounting on the printed circuit board including a bight portion (22) and two guide portions (20) between which the IC pack is inserted into mating connection with the bight portion;

5 a plurality of terminals (24) mounted on the bight portion adapted for interconnection of the IC pack to electrical traces on the printed circuit board; and

10 an electrical switch (30) on one of the guide portions of the header connector comprising a pair of spaced-apart contacts (32, 34), one of the contacts (32) including a movable contact portion located in the path of insertion of the IC pack which moves in a direction normal to the direction of insertion of the IC pack upon insertion of the IC pack into mating connection with the header
15 connector.

20 4. In a connector assembly for providing an interconnection between an IC pack (14) and an electronic apparatus, including a connector (12) coupled to the electronic apparatus into which the IC pack is inserted, said connector having a pair of guide arms (20) and a plurality of terminals (24) adapted for interconnection of the IC pack to the electronic, characterized by

25 an electrical switch (30) mounted on one of the guide arms comprising a pair of spaced-apart contacts (32, 34) closed by the IC pack during insertion of the IC pack into the connector.

30 5. In a connector assembly as set forth in claim 4, wherein one of the pair of spaced-apart contacts (32, 34) includes a movable contact portion (32a) located in the path of insertion of the IC pack and movable in a direction normal to the direction of insertion of the IC pack.



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