

ELECTRICAL CONNECTOR

Field of the Invention

The invention relates to printed circuit board (PCB) connectors and more particularly, to connectors for Serial Attached SCSI (SAS) receptacle PCBs.

Background of the Invention

PCB connectors are adapted to be connected to, and retained on, PCBs to transmit electrical signals between the PCB and an external device. PCB connectors comprise a plurality of individual terminals that are adapted to engage corresponding individual contact elements on the PCB.

The engagement may be by way of "press fit" terminals wherein the contact element is a socket in the PCB and the terminal is a laterally resilient plug adapted to be compressed laterally when inserted in the hole and retained therein by friction between the plug and the socket wall. Connectors employing this type of terminal may be retained on the PCB solely by these frictional forces.

Alternatively, the engagement may be by way of "compression terminals" wherein the electrical contact is a pad on the PCB and the terminal is adapted to resiliently compress when pressed against the pad. The pads occupy less surface area on the PCB than do the socket contacts, however, the compression terminals do not themselves retain the connector on the PCB and therefore, other means are required to secure the connector on the PCB and maintain the terminals compressed against the pads.

US Patent 5,975,921, issued 2 November 1999 in the name of Shuey, discloses a PCB connector having press fit and compression terminals arranged alternately. The mechanical interaction of the press fit terminals within the corresponding contact sockets in the PCB maintains the compression terminals against the contact pads. As the contact pads of the compression terminals require less surface area than the contact sockets of the press fit terminals, the alternating press fit/compression terminal arrangement allows the terminals to be arranged closer together than an arrangement with press fit terminals only.

SAS receptacles comprise multiple modules of terminals, with the terminals of one module requiring a pitch (distance between adjacent contact/terminal centres) of 0.8mm. The prior art SAS receptacle illustrated in Figures 1 to 4 consists of 22 terminals of 1.27mm pitch, as well as 7 terminals of 0.8mm pitch and employs press fit terminals only. Based on lab tests on 1.27mm pitch terminals, it has been concluded that terminals with press fit receptacle connectors with 0.8mm pitch substantially reduce electrical

performance when compared to terminals of 1.27mm pitch, due to the reduced distance between adjacent terminals. Electrical performance differences can be shown by their signal integrity using either high frequency signal simulation (HFSS) or (SPICE) models. At a pitch of 0.8mm, the distance between adjacent sockets, or anti-pad, is inhibitive-
5 small, causing greatly reduced signal integrity and increasing the chance of failure due to solder whiskering.

Object of the Invention

It is the object of the present invention to substantially overcome or at least ameliorate one or more of the disadvantages of the prior art.

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Summary of the Invention

Accordingly, the present invention provides an electrical connector for connecting to a printed circuit board, the connector comprising:

a base member;

a plurality of contact elements each having a body retained in the base member
15 and a tail portion extending from the base member;

wherein the contact elements are arranged in a plurality of modules, a first of the modules comprising only compression terminals and a second of the modules including press fit terminals,

wherein, when mounted to the printed circuit board, the tail portions of the press
20 fit terminals are adapted to engage corresponding apertures in the printed circuit board and hold the tail portions of the compression terminals against corresponding pads on the printed circuit board, and

wherein the tail portions of the compression terminals are adapted to resiliently deform when pressed against the pads on the printed circuit board.

25 Each module may have a different pitch to other modules. The first module may have a narrower pitch than the second module. In one particular application, the pitch of the first module is 0.8mm.

The compression terminals may be signal terminals and the press fit terminals may include power terminals.

30 The compression terminals may be substantially U-shaped.

The connector may further comprise a resiliently deformable plug for assisting in maintaining the compression terminals against the pads, the plug being adapted to form an interference fit within a hole on the printed circuit board. The plug may comprise a

cylindrical shaft with a resiliently deformable head that is compressed when the plug is inserted in the hole. Alternatively, the plug may be substantially U or V-shaped having opposing arms that are compressed towards each other when the plug is inserted in the hole. Further alternatively, the plug may be a substantially elongated 0-shape that is
5 laterally compressed when the plug is inserted in the hole.

Brief Description of the Drawings

Preferred embodiments of the invention will now be described with reference to the accompanying drawings wherein:

- Fig. 1 is an exploded view of a prior art SAS receptacle connector;
10 Fig. 2 is an assembled view of the prior art connector of Fig.1;
Fig. 3 is a view of the prior art connector of Fig.2 and a corresponding PCB;
Fig. 4 is an assembled view of the prior art connector and PCB of Fig.3;
Fig. 5 depicts a first embodiment of the connector and PCB of the present invention, with the terminals produced by formed stamping;
15 Fig. 6 is an assembled view of the connector and PCB of Fig.5;
Fig. 7 is an exploded view of a second embodiment of the connector, with the terminals produced by blanked stamping;
Fig. 8 is an assembled view of the connector of Fig.7;
Fig. 9 depicts a third embodiment of the connector of the present invention (with
20 terminals removed) having a plug to retain the connector on the PCB;
Fig. 10 depicts an alternative embodiment of the connector shown in Fig.9;
Fig. 11 depicts a further alternative embodiment of the connector shown in Fig.9;
and
Fig. 12 also depicts an alternative embodiment of the connector shown in Fig.9.

Detailed Description of the Preferred Embodiments

25 Figs. 5 and 6 show a first embodiment of an SAS receptacle connector 2 of the present invention. The connector 2 comprises a housing, formed from an insulating material such as plastic. The connector 2 and PCB 4 are specifically for SAS receptacles. SAS receptacle connectors and PCBs require the connector 2 to have a plurality of
30 modules 6, 8, each of which comprise a plurality of terminals 6a, 8a retained in the housing, with each module having a specific pitch. During installation, the terminals 6a, 8a can be inserted either individually or collectively and are maintained within their terminal cavities by friction fit. The terminals 6a, 8a have corresponding contacts 6b, 8b

on the PCB 4. A first of the modules 6 requires a pitch of 0.8mm. Press fit terminals, if used in the first module, would have an impaired signal integrity and an increased chance of failure due to solder whiskering. Therefore, the first module 6 comprises only compression terminals 6a. The other modules, including a second module 8, which do not require such a narrow pitch comprise press fit terminals 8a. The terminals 6a, 8a have a body portion housed within the modules 6, 8 and a tail portion 6a, 8a, which extends from the module 6, 8. The tail portions 6a of the compression terminals are substantially U-shaped and are adapted to be compressed against the contact pads 6b. The tail portions 8a of the press fit terminals are eyelet-shaped and adapted to be inserted into the socket contacts 8b and to be compressed laterally within the sockets 8b producing an interference fit between the press fit terminal tail portions 8a and the sockets 8b. The housing of the connector 2 has lateral projecting portions 9, which are adapted to engage a member (not shown), providing accurate orientation during mating and assisting in maintaining electrical contact between the connector 2 and PCB 4.

Fig. 6 shows the connector 2 mounted in this way on the PCB 4, which is normally installed in the back plane panel of electrical equipment. The compression terminal tail portions 6a are compressed and maintained against the contact pads 6b by the interference fit of the press fit terminal tail portions 8a within the contact sockets 8b. In this way, electrical contact between the connector 2 and PCB 4 of the SAS receptacle is maintained for all terminals, without the significant losses to signal integrity and risk of solder whiskering caused by narrow pitch press fit terminals.

The compression terminals 6a depicted in Figs. 5 and 6 are produced by formed stamping. Alternatively, the terminals may be produced by blanked stamping. A connector 2 having terminals 6a produced by blanked stamping is shown in Figs. 7 and 8.

Figs. 9 to 12 depict a third embodiment of connector 2 having an auxiliary plug for assisting in maintaining electrical contact between the compression terminals and the pads. The plug can be formed integrally with the connector 2 or alternatively, formed separately and attached to the connector 2. The plug is adapted to be inserted in a hole in the PCB and to form an interference fit therein. The plug may take a number of different forms including the four types depicted in Figs. 9 to 12.

The first type of plug 10, shown in Fig. 9, comprises a cylindrical shaft 12 and a resiliently deformable head 14 adapted to be compressed when inserted in the hole.

The second type of plug 20, shown in Fig. 10 comprises a substantially V-shaped shaft having two opposing arms 22 with tapered tips, the arms 22 being adapted to be

compressed towards each other when the shaft is inserted into the hole. The third type of plug 30, shown in Fig. 11, is similar to the first type 10, but further comprising a diametrical slot cut axially into the head and shaft to give a substantially U-shaped plug and facilitate lateral compression of the plug 30 when inserted in the hole. The fourth
5 type of plug 40, shown in Fig. 12, comprises a substantially elongated 0-shaped shaft having a substantially elliptical eyelet 42, the shaft being adapted to be laterally compressed when inserted into the hole.

Although the invention has been described with reference to specific examples, it will be appreciated by those skilled in the art that the invention may be embodied in many
10 other forms.

Claims

1. An electrical connector for connecting to a printed circuit board, the connector comprising:

a base member;

5 a plurality of contact elements each having a body retained in the base member and a tail portion extending from the base member;

wherein the contact elements are arranged in a plurality of modules and a first of the modules comprises only compression terminals and a second of the modules includes press fit terminals,

10 wherein when mounted to the printed circuit board, the tail portions of the press fit terminals are adapted to engage corresponding apertures in the printed circuit board and hold the tail portions of the compression terminals against corresponding pads on the printed circuit board, and

wherein the tail portions of the compression terminals are adapted to resiliently deform when pressed against the pads on the printed circuit board.

2. The connector of claim 1, wherein each module has a different pitch to the other modules.

3. The connector of claim 1, wherein the first module has a narrower pitch than the second module.

20 4. The connector of claim 3, wherein the first module has a pitch of 0.8mm.

5. The connector of claim 1, wherein the compression terminals are signal terminals and the press fit terminals include power terminals.

6. The connector of claim 1, wherein the compression terminals are
25 substantially U-shaped.

7. The connector of claim 1, further comprising a resiliently deformable plug for assisting in maintaining the compression terminals against the pads, the plug being adapted to form an interference fit within a hole on the printed circuit board.

8. The connector of claim 7, wherein the plug comprises a cylindrical shaft
30 with a resiliently deformable head that is compressed when the plug is inserted in the hole.

9. The connector of claim 7, wherein the plug is substantially V- or U-shaped, having opposing arms that are compressed towards each other when the plug is inserted in the hole.

10. The connector of claim 7, wherein the plug is a substantially elongated O-shape that is laterally compressed when the plug is inserted in the hole.