

CONNECTOR

TECHNICAL FIELD

The present invention relates to the art of connectors and, particularly to an electrical connector adapted for mounting on a printed circuit board.

5 BACKGROUND

It is known that a printed circuit board (PCB) connector provides a connectable interface between a PCB and another device with a complementary mating connector. A PCB connector may be mounted on a PCB in many ways; directly soldering the PCB connector to a copper-coated pad on a surface of the
10 PCB (often referred to as surface mounting) is one of them.

A surface mount connector (usually a receptacle) typically include a housing with a mating face for mating with a complementary connector (usually a plug) and a board-mounting end from which a plurality of terminals exit the housing for termination to circuit traces on the PCB. The surface mount
15 receptacle may further include a plurality of mounting posts at the base of the housing for the purpose of aiding the alignment of the surface mount receptacle to the PCB during mounting.

The terminals normally include mating portions for mating with the terminals of the complementary plug connector and tail portions (often known as
20 'solder tails') projecting from the housing for interconnection, as by soldering, to circuit traces on the PCB or in holes in the PCB into which the tails are inserted. The solder tails are typically arranged in a single row or coplanar rows for automated connection to the conductive pads on the PCB.

With the miniaturisation of electronic equipment, small-sized surface
25 mount receptacles with very fine solder tails have been developed. This is

because the footprint allocated for each internal component is reduced to accommodate the limited internal space within the electronic equipment. U.S. Publ. No. 2006/0009080 and U.S. Publ No. 2006/0014438 disclose one such surface mount receptacle. Besides the mounting posts on the surface mount
5 receptacle which are used for connector alignment with the PCB, the solder tails when soldered to the PCB often become the only means of securing the surface mount receptacle onto the PCB.

It is a common practice to connect cables to a PCB by terminating the cables to a plug connector (often jointly referred to as cable assembly) and then
10 mating the plug connector to a surface mount receptacle on the PCB. A known problem with connecting a cable assembly to a PCB surface mount receptacle is the tendency for the cable's weight and movement to loosen the points of attachment of the surface mount receptacle to the PCB, thereby breaking signal pathways and causing the connection to the PCB to fail.

15 Sometimes, in an attempt to minimise the above problem, a large guide frame is used and is mounted to the PCB. However, such guide frames are large and take up valuable space on the PCB that could be used for additional circuits or terminations. In addition, in small, confined spaces as in a miniaturised electronic equipment, it is difficult to provide additional anchorage points for the
20 guide frames without increasing the footprint of the surface mount receptacle.

The present invention is directed at solving the above problems by providing an improved structure for anchoring and holding a connector of the character described to a PCB.

SUMMARY

It would be desirable to provide a connector with an improved structure that can secure the connector to a printed circuit board and prevent the connector from lifting off due to the cable assembly's weight and movement.

5 In accordance with one embodiment of the present invention, there is provided an electrical connector, comprising:

an insulative housing that has a top, a bottom, a first side, a second side, all four sides connected to form a mating face and a board-mounting end;

10 a plurality of terminals supported in the housing and terminating at the board-mounting end wherein each terminal further comprises a contact portion configured to establish electrical contact with a complementary mating connector, a solder tail that extends out of the housing at the board-mounting end, a body portion that is disposed intermediate the contact portion and the solder tail and which interconnect them together;

15 a plurality of solder tabs engaged with the housing; and

a plurality of engagement portions coupled to the housing to confine the solder tabs to a predetermined position with respect to the housing.

20 In accordance with another embodiment of the present invention, there is provided an electrical connector configured to be mounted on a printed circuit board comprising:

an insulative housing that has a top, a bottom, a first side, a second side, all four sides connected to form a mating face and a board-mounting end wherein at the mating face, there is at least one mating slot extending into the housing;

a plurality of terminals supported in the housing and terminating at the board-mounting end wherein the terminals are grouped into a first set and a second set and each terminal in the first set and the second set further comprises a contact portion that extends into the mating slot, a solder tail that extends out of the housing at the board-mounting end, a body portion that is disposed intermediate the contact portion and the solder tail and which interconnect them together;

a plurality of solder tabs engaged with the housing; and

a plurality of engagement portions coupled to the housing to confine the solder tabs to a predetermined position with respect to the housing.

BRIEF DESCRIPTION OF THE DRAWINGS

An exemplary form of the present invention will now be described with reference to the accompanying drawings in which:

5 **Figure 1A** shows a prior art cable assembly with a plug connector aligned to mate with a receptacle connector surface mounted on a printed circuit board and a guide member in position to be soldered on the printed circuit board;

Figure 1B shows the plug connector of the cable assembly of Figure 1A engaged with the receptacle connector surface mounted on the printed circuit board and the guide member in place between the plug connector and the
10 receptacle connector;

Figure 2A is an exploded perspective view of an exemplary connector of the present invention;

Figure 2B is a perspective view of the assembled exemplary connector of Figure 2A;

15 **Figure 3** is a front view of the exemplary connector of Figure 2B looking towards a mating face of the connector;

Figure 4 is a perspective view of a horizontal cross-section of the exemplary connector of Figure 2B with a plurality of solder tabs aligned in position to be engaged with the connector;

20 **Figures 5A and 5B** are perspective views and **Figure 5C** is a side view of the housing and engagement portion of the exemplary connector of Figure 2B; and

Figure 6 is a perspective view of one embodiment of a solder tab which forms part of the exemplary connector of Figure 2A.

While the above-identified figures set forth several embodiments of the invention, other embodiments are also contemplated, as noted in the detailed description. In all cases, this disclosure presents aspects of the invention by way of representation and not limitation. It should be understood that numerous other
5 modifications and embodiments can be devised by those skilled in the art, which fall within the scope and spirit of the principles of the invention. The figures may not be drawn to scale. Like reference numbers have been used throughout the figures to denote like parts.

DETAILED DESCRIPTION

Figures 1A and 1B show a prior art receptacle connector **2** soldered into place on a printed circuit board (PCB) **4** via a plurality of solder tails **226**. Electrical signals between the conductive traces **6** of the PCB **4** and a cable assembly **11** can be exchanged by terminating the cables **9** at a plug connector **10** and mating the plug connector **10** with the receptacle connector **2**. The plug connector **10** is at least partially guided into place by way of a guide member **8** associated with the receptacle connector **2**, and this guide member **8** is mounted via a plurality of mounting posts **206** to the PCB **4** in a location that is forward of and spaced apart from the receptacle connector **2**.

For a small receptacle connector **2**, the solder tails **226** by which the receptacle connector **2** are soldered onto the PCB **4** are very fine. Other than a plurality of mounting posts on the connector housing, the points of attachment where the solder tails **226** are soldered onto the PCB **4** are often the only means in which the receptacle connector **2** is anchored and secured on the PCB **4**. Due to the great disparity between the weight of the cable assembly **11** and the amount of solder contact at the points of attachment, any movement of the cable assembly **11** can add great mechanical stress to the solder tails **226** and loosen the points of attachment of the solder tails **226** causing the receptacle connector **2** to lift off the PCB **4**, thereby breaking signal pathways and causing the connection to the PCB **4** to fail. The present invention is directed at resolving the problem of the receptacle connector **2** lifting off the PCB **4** and thus, minimising the likelihood of premature PCB connection failure.

Referring to Figures 2, 3 and 4, an exemplary connector **200** in accordance with the present invention comprises an insulative housing **201** that has a top **202**, a bottom **203**, a first side **204**, a second side **205**, all four sides connected to form a mating face **207** and a board-mounting end **208**; a first set and a second set of terminals **220**, **221** supported in the housing **201** and terminating at the

board-mounting end **208**; a plurality of solder tabs **300** engaged with the housing **201** and a plurality of engagement portions **400** coupled to the housing **201** to confine the solder tabs **300** to a predetermined position with respect to the housing **201**. The bottom **203** of the housing **201** may include a plurality of
5 mounting posts **206** for the purpose of positioning the connector **200** on the PCB **4**. Preferably at the mating face **207**, there is a mating slot **210** that receives a complementary plug connector **10** of a cable assembly **11**. The mating slot **210** extends into the interior of the housing **201** and is bounded by a top wall **212**, a bottom wall **213**, two side walls **214**, **215** and a rear wall **216**.

10 It should be noted that the arrangement of the two connectors in this description (i.e. a receptacle connector on the PCB and a plug connector at an end of a cable assembly) has been presented for the purpose of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed, since many modifications or variations (e.g. a plug
15 connector on the PCB and a receptacle connector at an end of a cable assembly) thereof are possible in light of this teaching. All such modifications and variations are within the scope of the invention.

The first set of terminals **220** and the second set of terminals **221** extend into the mating slot **210** and provide an electrical transmission path from the
20 cable assembly **11** to the PCB **4**. The first set of terminals **220** is similar to the second set of terminals **221** in that each terminal in the two sets include a contact portion **225** that extends into the mating slot **210** and a solder tail **226** that extends out of the housing **201** for attachment to the PCB **4** on which the connector **200** is to be mounted. Each terminal also includes a body portion **227**
25 that is disposed intermediate the contact portion **225** and the solder tail **226** and which interconnect them together. Each terminal may further comprise a retention portion **229** which primarily serve to retain the terminal in place within the housing **201**.

The first set of terminals **220** are inserted into a plurality of top slots **230** that are formed in the top wall **212** of the housing **201** which include openings that communicate with the mating slot **210** and are positioned so that the contact portions **225** of the first set of terminals **220** may at least partially extend into the mating slot **210**. The second set of terminals **221** are inserted into a plurality of bottom slots **235** that are formed in the bottom wall **213** of the housing **201** which include openings that communicate with the mating slot **210** and are positioned so that the contact portions **225** of the second set of terminals **221** may at least partially extend into the mating slot **210**.

Referring to Figures 5A, 5B and 5C, in one embodiment of the present invention there is at least one engagement portion **400** coupled to at least one side of the housing **201** preferably with a general 'C-shape' creating a sleeve with the housing **201** comprising a top portion **402**, a vertical portion **404** and a bottom portion **403**. Preferably, both the top portion **402** and bottom portion **403** have a step at the side contiguous to the side of the housing **201** thereby creating a insertion slot between the engagement portion **400** and the side of the housing **201** comprising a top ledge **405** and a bottom ledge **406**.

Referring to Figure 6, in one embodiment of the present invention, there is at least one solder tab **300** engaged with at least one side of the housing **201** wherein each solder tab **300** comprises a solder contact portion **310**, an interconnect portion **330** and a structure support portion **320** bridging the solder contact portion **310** and the interconnect portion **330**.

The solder contact portion **310** may be stamped as part of the structure support portion **320** and may either extend away from the side of the housing **201** or extend towards the side of the housing **201**. The solder contact portion **310** when soldered to the PCB **4** provides additional points of attachment for the surface mount receptacle **200** thereby further securing the surface mount receptacle **200** to the PCB **4** and preventing the surface mount receptacle **200**

from lifting off the PCB 4 due to the weight or movement of the cable assembly. Alternatively, the solder contact portion 310 may extend downwards towards the PCB 4 similar to the mounting post 206 and may either soldered or press-fitted into the PCB 4 for additional support.

5 In one embodiment of the present invention, the interconnect portion 330 comprises a first edge 331, a second edge 332, a first face 333, a second face 334 connected to form a distal end 335 and wherein the first edge 331, the second edge 332, the first face 333 and the second face 334 taper towards the distal end 335. Tapering the two edges 331, 332 and the two faces 333, 334 near the distal
10 end 335 reduces the amount of force needed to insert the interconnect portion 330 in the direction from the mating face 207 to board-mounting end 208 into the insertion slot bounded by the top ledge 405 and the bottom ledge 406 between the engagement portion 400 and the side of the housing 201.

 In one embodiment of the present invention, the interconnect portion 330
15 further comprises a plurality of indentations 336 along the first edge 331 and/or the second edge 332. Each indentation 336 may be sized, shaped, arranged and oriented similarly or differently. The characteristics and arrangement of each indentation 336 are designed to provide adequate frictional contact between the interconnect portion 330 of the solder tab 300 and the top ledge 405 and/or
20 bottom ledge 406 of the engagement portion 400 once the interconnect portion 330 is fully inserted into the insertion slot bounded by the top ledge 405 and the bottom ledge 406 between the engagement portion 400 and the side of the housing 201. As parts of the indentations 336 penetrate into the top ledge 405 and/or bottom ledge 406, the indentations 336 become anchorage points securing
25 the solder tab 300 to the connector 200 because the engagement portion 400 is coupled to the side of the housing 201.

 In one embodiment of the present invention, the solder tab 300 further comprises a locking device 337 to prevent the accidental disengagement of the

solder tab 300 from the connector 200. The locking device 337 may include, but is not limited to, a resilient side locking latch extending inwards from the first face 333 to the second face 334 of the interconnect portion 330. Preferably, the housing 201 include a hollow area 420 in the form of a recess in the side of the housing 201 contiguous to the engagement portion 400. The hollow area 420 may include, but is not limited to, a lengthwise slot in the housing 201 contiguous to the insertion slot bounded by the top ledge 405 and the bottom ledge 406 of the engagement portion 400. As the interconnect portion 330 of the solder tab 300 gets inserted into the insertion slot bounded by the top ledge 405 and the bottom ledge 406, the side locking latch is flexed outwards with respect to the side of the housing 201 until it passes a lead-in edge 422 of the hollow area 420 whereby the side locking latch then returns to its original position. In this case, the hollow area 420 acts as a "keyway" for the side locking latch such that in the event that a disengagement force is exerted in a direction reverse to the insertion direction, the lead-in edge 422 of the hollow area 420 will oppose the reverse movement of the side locking latch thereby preventing the solder tab 300 from decoupling with the housing 201.

The foregoing description of the preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed, because many modifications or variations thereof are possible in light of the above teaching. All such modifications and variations are within the scope of the invention. The embodiments described herein were chosen and described in order to best explain the principles of the invention and its practical application, thereby to enable others skilled in the art to utilise the invention in various embodiments and with various modifications as are suited to the particular use contemplated thereof. It is intended that the scope of the invention be defined by the claims appended hereto, when interpreted in accordance with the full breadth to which they are legally and equitably suited.

CLAIMS

1. An electrical connector comprising:
 - an insulative housing that has a top, a bottom, a first side, a second side, all four
 - 5 sides connected to form a mating slot configured to receive a complementary mating connector, a mating face and a board-mounting end;
 - a plurality of terminals supported in the housing and terminating at the board-mounting end wherein each terminal further comprises a contact portion configured to establish electrical contact with the complementary mating connector, a solder tail that
 - 10 extends out of the housing at the board-mounting end, a body portion that is disposed intermediate the contact portion and the solder tail and which interconnect them together;
 - a plurality of solder tabs engaged with the housing; and
 - a plurality of engagement portions coupled to the housing to confine the solder tabs to a predetermined position with respect to the housing, wherein an engagement portion
 - 15 forms a sleeve with the housing comprising a top portion and a bottom portion.
2. The electrical connector as claimed in claim 1 wherein a major portion of the solder tabs is positioned behind the mating face.
- 20 3. The electrical connector of claim 1 wherein the engagement portion further comprises a vertical portion connecting the top portion to the bottom portion to form a general 'C' shape.
4. The electrical connector of claim 3 wherein the top portion and bottom portion
- 25 each has a step at the side contiguous to the side of the housing thereby creating an insertion slot between the engagement portion and the side of the housing.
5. The electrical connector as claimed in any one of claims 1 to 4 wherein there is at least one solder tab coupled to at least one side of the housing, each solder tab further
- 30 comprises a solder contact portion, an interconnect portion and a structure support portion bridging the solder contact portion and the interconnect portion together.

6. The electrical connector of claim 5 wherein the solder contact portion may be stamped as part of the structure support portion and extends away from the side of the housing.

5 7. The electrical connector of claim 5 wherein the solder contact portion may be stamped as part of the structure support portion and extends towards the side of the housing.

8. The electrical connector of claim 5 wherein the solder contact portion may be stamped as part of the structure support portion and extends downwards away from the bottom of the housing.

9. The electrical connector as claimed in any one of claims 5 to 8 wherein the interconnect portion further comprises a first edge, a second edge, a first face, a second face connected to form a distal end and wherein the first edge, the second edge, the first face and the second face taper towards the distal end.

10. The electrical connector as claimed in any one of claims 5 to 9 wherein the interconnect portion further comprises a plurality of indentations along at least one edge of the interconnect portion.

11. The electrical connector as claimed in any one of claims 5 to 10 wherein the solder tab further comprises a locking device to prevent the accidental disengagement of the solder tab from the connector.

12. The electrical connector of claim 11 wherein the locking device comprises a resilient side locking latch extending inwards from the first face to the second face of the interconnect portion.

13. The electrical connector as claimed in claim 11 or claim 12 wherein the housing further comprises a hollow area in the form of a recess at the side of the housing contiguous to the engagement portion configured to engage the locking device.

14. An electrical connector comprising:

an insulative housing that has a top wall, a bottom wall, a first side, a second side, all four sides connected to form a mating face and a board-mounting end wherein at the mating face, there is at least one mating slot extending into the housing;

5 a plurality of terminals supported in the housing and terminating at the board-mounting end wherein the terminals are grouped into a first set inserted into the housing through openings in the top wall of the housing and a second set inserted into the housing through openings in the bottom wall of the housing, and each terminal in the first set and the second set further comprises a contact portion that extends into the mating slot, a
10 solder tail that extends out of the housing at the board-mounting end, a body portion that is disposed intermediate the contact portion and the solder tail and which interconnect them together;

a plurality of solder tabs engaged with the housing; and

a plurality of engagement portions coupled to the housing to confine the solder tabs

15 to a predetermined position with respect to the housing, wherein an engagement portion forms a sleeve with the housing comprising a top portion and a bottom portion.

15. An electrical connector comprising:

an insulative housing that has a top, a bottom, a first side, a second side, all four
20 sides connected to form a mating face and a board-mounting end;

a plurality of terminals supported in the housing and terminating at the board-mounting end wherein each terminal further comprises a contact portion configured to establish electrical contact with a complementary mating connector, a solder tail that extends out of the housing at the board-mounting end, a body portion that is disposed
25 intermediate the contact portion and the solder tail and which interconnect them together;

a plurality of solder tabs engaged with the housing; and

a plurality of engagement portions coupled to the housing to confine the solder tabs to a predetermined position with respect to the housing, wherein an engagement portion forms a sleeve with the housing comprising a top portion and a bottom portion, wherein
30 there is at least one solder tab coupled to at least one side of the housing, each solder tab further comprises a solder contact portion, an interconnect portion and a structure support portion bridging the solder contact portion and the interconnect portion together.