

SPECIFICATION

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ELECTRICAL CONNECTOR FOR MOUNTING ON A
PRINTED CIRCUIT BOARD AND METHOD OF FABRICATING SAMEField of the Invention

5 This invention generally relates to the art of electrical connectors and, particularly, to an electrical connector for mounting on a surface of a printed circuit board, along with a method of fabricating the connector.

Background of the Invention

10 A known type of input/output (I/O) electrical connector includes an elongated dielectric housing having a front mating face and a rear face with a plurality of terminal-receiving passages extending therebetween. The faces extend longitudinally between opposite ends of the
15 elongated housing. A plurality of terminals are received in the passages. Each terminal includes a forwardly projecting contact portion and a tail portion projecting rearwardly from the housing beyond the rear face thereof. The terminal tails often are terminated to circuit traces
20 on a printed circuit board. The terminal tails may be inserted into holes in the board for solder connection to circuit traces on the board and/or in the holes. The terminal tails also may be surface mounted to circuit pads on one side of the printed circuit board. In the latter
25 applications, ends of the tails are bent at an angle for surface mounting on the board. Some such surface mount connectors are called "vertical" connectors, and the end sections of the tails are bent at right angles.

30 One of the problems with surface mounted electrical connectors as described above is in maintaining co-planarity of the bent portions of the terminal tails. This co-planarity is important because of the planar



configuration of the circuit traces on the printed circuit board. If the bent portions are not sufficiently coplanar, defective solder connections may result. Heretofore, attempts have been made to bend the terminal tails around a portion of the connector housing, but this method causes considerable problems when the housing is fabricated of dielectric material such as plastic or the like. The housing often warps and destroys any planarity thereof.

Another disadvantage in bending terminal tails around a portion of the connector housing is that there typically is not sufficient space between the housing and the tails and/or the printed circuit board to allow for proper inspection. In other words, the housing does not allow inspection of the solder joints, especially in the areas of the bends of the tail portions.

Therefore, rather than bending the terminal tails against the connector housing, co-planarity is best achieved by using appropriate holding, clamping and/or bending tooling which can be manufactured very precisely with planar surfaces. Unfortunately, many surface mount electrical connectors of the character described above do not allow for sufficient space at the rear face of the connector housing and/or between rows of adjacent terminal tails to allow for proper use of appropriate tooling. Either the tooling is extremely expensive or cannot be used at all.

The present invention solves the above conflicting problems of using either the connector housing or expensive tooling to bend the terminal tail portions, by employing a supporting anvil directly on the connector housing which cooperates with holding and bending tooling to effect the bending of the terminal tails of a surface mounted electrical connector.

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Summary of the Invention

An object, therefore, of the invention is to provide a new and improved electrical connector for mounting on a surface of a printed circuit board, along with a method of fabricating the connector.

In the exemplary embodiment of the invention, the connector generally includes a dielectric housing having a body portion with a rear face spaced from the printed circuit board. A plurality of terminals are mounted on the body portion and have tail portions projecting rearwardly beyond the rear face. The tail portions have angled sections for surface mounting on the printed circuit board. A supporting anvil projects from the rear face of the housing adjacent the tail portions of the terminals and against which the tail portions can be supported by appropriate tooling during bending of the angled sections of the terminals.

As disclosed herein, the dielectric housing is elongated and has a pair of board-mounting portions at opposite ends thereof. The body portion is elongated and extends between the board-mounting portions. The terminals are mounted in two rows, with two rows of tail portions projecting rearwardly from the body portion beyond the rear face thereof. The tail portions include right-angled end portions for surface mounting on the printed circuit board. The supporting anvil comprises an elongated rib projecting from the rear face of the elongated body portion between the two rows of terminal tail portions and juxtaposed against the tail portions. The elongated rib provides the supporting anvil against which the two rows of tail portions can be supported by appropriate tooling during bending of the right-angled end portions of the terminals.

Preferably, the housing, including the end board-mounting portions, the central body portion and the

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elongated supporting rib, is a one-piece structure unitarily molded of plastic material.

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:

FIGURE 1 is a top perspective view of a surface mount electrical connector embodying the concepts of the invention, the connector being surface mounted on a printed circuit board;

FIGURE 2 is a side elevational view of the connector;

FIGURE 3 is an end elevational view of the connector;

FIGURE 4 is a bottom perspective view of the connector;

FIGURE 5 is a vertical section taken generally along line 5-5 of Figure 2;

FIGURES 6A-6C show sequential views of bending the terminal tails according to the invention;

FIGURES 7A-7C show sequential views of an attempt to bend the terminal tails without the concepts of the invention;

FIGURE 8 is a section through a prior art connector; and

FIGURE 9 is a section similar to that of Figure 5, showing the line of sight affording good visibility of the terminal tail connections.

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Detailed Description of the Preferred Embodiment

Referring to the drawings in greater detail, and first to Figures 1-5, the invention is embodied in an electrical connector, generally designated 10, which is designed for mounting on a surface of a printed circuit board 11. The connector includes a one-piece housing, generally designated 12, which can be unitarily molded of dielectric material such as plastic or the like. The housing is elongated and has an elongated central body portion 12a which extends between a pair of end board-mounting portions 12b. The housing further has a mating portion 16 defining a front mating face 16a. End portions 12b define a board-mounting face 18 of the connector. Two rows of terminal-receiving passages 19 (Fig. 5) extend between the opposite faces of central body portion 16 and mount a plurality of terminals, generally designated 20, in two rows. The terminals have contact portions 21 inside opposite side walls of mating portion 16. The terminals have tail portions 22 which project rearwardly from body portion 12a beyond a rear face 23 of the central body portion. Tail portions 22 terminate in right-angled end portions 22a.

Still further, housing 12 includes a pair of wing portions 24 projecting upwardly from board-mounting portions 12b and spaced outside opposite ends of mating portion 16. These wing portions facilitate the mating of connector 10 with a complementary mating connector (not shown). The mating connector will have a receptacle for receiving mating portion 16, along with a tongue for insertion into an elongated slot 26 within mating portion 16. Appropriate terminals of the mating connector will have contact portions on opposite sides of the tongue for engaging contact portions 21 of the two rows of terminals inside the side walls of mating portion 16.

Housing 12 of connector 10 includes a pair of integrally molded polarization pegs 27 which project from board-mounting face 18 of the housing. The pegs are inserted into appropriate holes in circuit board 11 to properly locate and orient the connector on the board. The polarizing pegs are of two different sizes to serve as a polarization feature in order to facilitate correct orientation of the connector on the board. As seen best in Figure 4, one of the pair of pegs 27 is disposed on each opposite end of the longitudinal housing. In addition, a pair of stamped and formed metal boardlocks 28 also are mounted at opposite ends of the elongated housing. The boardlocks are received in appropriate locking holes 30 (Fig. 3) in printed circuit board 11.

As best seen in Figures 2, 4 and 5, the invention contemplates an elongated rib 32 projecting from rear face 23 of elongated body portion 12a between the tail portions 22 of the two rows of terminals 20. The elongated rib is integrally molded with the unitary plastic housing. An integrally molded stiffening flange or gusset 33 joins the sides of the elongated rib to rear face 23 of the housing. As will be understood hereinafter, elongated rib 32 is juxtaposed against the tail portions inside the two rows thereof to provide a supporting anvil against which the two rows of tail portions can be supported by appropriate tooling during bending of right-angled end portions 22a of the terminals.

More particularly, referring to Figures 6A-6C, it can be seen in Figure 6A that one row of terminals 20 has been inserted into terminal-receiving passages 19 of housing 12 in the direction of arrow "A". Tail portions 22 of the terminals project beyond rear face 23 of the body portion of the housing and against one side of supporting rib 32, but the right-angled end portions of the terminal tails have not as yet been bent.

Figure 6B shows a holding tool 34 inserted in the direction of arrow "B" beneath rear face 12a of the housing body portion to clamp terminal tails 22 against one side of supporting rib 32. Therefore, the supporting rib acts as a supporting anvil against which the terminal tails are clamped by the holding tool. A bending tool 36 then is moved from a first position shown in phantom in Figure 6B, in the direction of arrow "C" to a position shown in solid lines whereby end portions 22a of the terminals are bent at right angles to tail portions 22. It can be understood that holding tool 34 can be manufactured with precision and include a precise planar surface facing the bending tool and against which the right-angled end sections of the terminal tails are bent. During the bending operation, rib 32 of the housing cooperates with holding tool 34 to clamp the terminal tails in their precise position relative to the connector housing.

Figure 6C shows that the second row of terminals 20, after being inserted into their respective terminal-receiving passages 19, is bent substantially identically to the description above in relation to the other row of terminals as referenced in Figure 6B. Specifically, a second holding tool 38 is moved in the direction of arrow "D" to clamp terminal tails 22 of the second row of terminals against the opposite side of supporting rib 32. With the rib acting as a supporting anvil, bending tool 36 then is rotated in the direction of arrow "E" to effect the right-angled bend in end portions 22a of the second row of terminals.

Figures 7A-7C show the problem of providing tooling for an electrical connector, generally designated 10A, which does not have the novel supporting rib or anvil 32 according to the invention. It can be seen in Figure 7A that the terminal tails 22 project considerably from rear face 23 of the connector housing without any support.

Therefore, two holding tools 40 and 42 must be used as shown in Figure 7B in order to bend the tail portions of the terminals by bending tool 36. A significant problem occurs when attempting to bend the second row of terminals as shown in Figure 7C. Some form of complicated holding tool 44 must be inserted between the two rows of terminal tails to clamp the second row of terminal tails before bending tool 36 could possibly bend end portions 22a of the terminals at right-angles. In addition, the holding tool 44 must provide sufficient clearance for the insertion and movement of bending tool 36. Such a supporting and bending tool apparatus would be quite complicated and quite expensive, if at all possible. The use of supporting rib 32 of the invention as a supporting anvil is an extremely simple, inexpensive and efficient expedient involving only the molding of an additional portion depending from the rear face of the housing body portion.

Figures 8 and 9 show another advantage of the invention in comparison to the prior art. As stated in the "Background", above, terminal tails have been bent around portions of connector housings, but it is very difficult to maintain any co-planarity of the bent portions of the terminals. In addition, Figure 8 shows another problem wherein visualization of the solder joints of the terminal tails, particularly at the bends 46 thereof, is not adequate. Therefore, proper inspections of the solder joints are not possible. Figure 8 shows one line of sight 48 which does not even afford visual inspection of the solder joints. Line of sight 50 is a very poor line, at most. Figure 9 shows that by spacing or elevating rear face 23 of the housing body portion above printed circuit board 11, and using elongated supporting rib 32 depending from the rear face according to the invention, a very good line of sight 52 is created to afford good inspection of the solder joints of all the terminals.

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Finally, still another advantage of supporting rib 32 is that the rib acts as a stiffener to resist bowing or warping of the central body portion of the connector housing.

5 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
10 in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

CLAIMS

1. An electrical connector for mounting on a surface of a printed circuit board, comprising:

an elongated dielectric housing having a pair of board-mounting portions at opposite ends thereof and an elongated central body portion extending between the board-mounting portions, the central body portion including a front mating face, a rear face and two rows of terminal-receiving passages extending between the faces, and the rear face being spaced from the printed circuit board upon mounting the connector on the board;

a terminal received in at least some of said passages, each terminal including a forward contact portion projecting toward said mating face and a tail portion projecting rearwardly from the body portion beyond said rear face, the tail portions including right-angled end portions for surface mounting on the printed circuit board; and

an elongated rib projecting from the rear face of the elongated body portion between the two rows of terminal tail portions and juxtaposed against the tail portions to provide a supporting anvil against which the two rows of tail portions can be supported by appropriate tooling during bending of the right-angled end portions of the terminals.

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2. The electrical connector of claim 1 wherein said housing, including the end board-mounting portions, the central body portion and the elongated rib, is a one-piece structure unitarily molded of plastic material.

5 3. An electrical connector for mounting on a surface of a printed circuit board, comprising:

 a dielectric housing having a body portion with a rear face spaced from the printed circuit board;

10 a plurality of terminals mounted on the body portion and having tail portions projecting rearwardly beyond said rear face, the tail portions having angled sections for surface mounting on the printed circuit board; and

15 a supporting anvil projecting from the rear face of the housing adjacent the tail portions of the terminals and against which the tail portions can be supported by appropriate tooling during bending of the angled sections of the terminals.

20 4. The electrical connector of claim 3 wherein said supporting anvil is integral with the housing.

25 5. The electrical connector of claim 3, including at least one row of said terminals mounted on the housing, and said supporting anvil comprises an elongated rib juxtaposed against one side of a row of tail portions of the terminals projecting from the rear face of the housing.

30 6. The electrical connector of claim 5, including two rows of said terminals mounted on the housing, with said elongated rib being disposed between two rows of tail portions of the terminals.

7. The electrical connector of claim 3 wherein said housing is elongated and includes a pair of board mounting portions at opposite ends of the body portion.

5 8. The electrical connector of claim 7 wherein said housing, including the board-mounting portions, the body portion and the supporting anvil, is a one-piece structure unitarily molded of plastic material.

10 9. A method of fabricating an electrical connector for mounting on a surface of a printed circuit board, comprising the steps of:

providing a connector housing with a body portion having a rear face, and a supporting rib projecting from the rear face toward the printed circuit board;

15 mounting a plurality of terminals on the housing with tail portions projecting from the rear face and juxtaposed against one side of the supporting rib;

clamping the tail portions of the terminals against said one side of the supporting rib by appropriate clamping tooling; and

20 bending right-angled end portions of the terminals while tail portions are clamped between the supporting rib and the clamping tooling.

25 10. The method of claim 9, including mounting said terminals on the housing with tail portions juxtaposed against opposite sides of the supporting rib, clamping the tail portions against opposite sides of the rib, and bending the tail portions while clamped against the rib.