

SPECIFICATION

LOW PROFILE ELECTRICAL CONNECTOR FOR FLAT CIRCUITS

Field of the Invention

5 This invention generally relates to the art of electrical connectors and, particularly, to a connector for flat circuits including flexible flat circuits, flexible printed circuit boards and the like.

Background of the Invention

10 There are a wide variety of electrical connectors particularly adapted for terminating flat circuits, such as flexible flat circuits. Typically, such electrical connectors are zero insertion force connectors. These connectors conventionally use actuators to bias the flat circuits against resilient contacts or terminals which are
15 mounted in the connector housings. The actuators may be push-pull type actuators, or the actuators may be pivotable between first, open positions allowing free insertion of the circuits into the connector housing and second, closed positions clamping the flat circuits against the terminals.

20 In some applications, it is highly desirable that the electrical connectors for flat circuits be as thin as possible. In other words, it is desirable that the connectors have a "low profile". This is particularly true when the connectors are adapted for mounting on a printed
25 circuit board or the like, wherein the height of the connector above the board is a major consideration.

30 Unfortunately, problems are encountered in providing a low profile connector for flat circuits, because the terminals typically include mounting sections or posts for locking the terminals in the connector housing. When the terminals are inserted into the front or rear of the housing (i.e. generally parallel to the circuit



board on which the housing is mounted), the mounting sections of the terminals require space in the height direction which, in turn, increases the thickness or height of the connector. The present invention is directed to solving these problems by providing a unique electrical connector for flat circuits wherein the terminals are mounted through a bottom face of the connector housing.

Summary of the Invention

An object, therefore, of the invention is to provide a new and improved electrical connector for flat circuits, of the character described.

In the exemplary embodiment of the invention, the connector includes a low profile housing having a bottom face and a front end. An elongated opening is provided in the front end for receiving an end of a flat circuit inserted into the opening in a direction generally parallel to the bottom face. A plurality of mounting recesses are provided in the bottom face of the housing spaced longitudinally of the opening. A plurality of terminals are mounted through the bottom face of the housing and include mounting sections inserted into the mounting recesses. The terminals have contact sections for engagement with the flat circuit at the elongated opening.

As disclosed herein, the mounting sections of the terminals are spaced from the contact sections thereof in a direction generally parallel to the bottom face of the housing. The mounting sections comprise mounting posts inserted into the mounting recesses in the bottom face of the housing. In the preferred embodiment, the bottom face of the housing is adapted for mounting on a surface of a printed circuit board. The terminals include tail sections generally flush with the bottom face for connection to appropriate circuit traces on the printed circuit board.



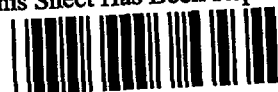
5 The contact section of each terminal herein is shown to be one leg of a generally U-shaped portion of the terminal. The one leg is located at one side of the elongated opening, and a second leg of the generally U-shaped portion of each terminal is located at an opposite side of the elongated opening. An actuator is movably mounted on the housing for biasing the flat circuit against the one legs which comprise the contact sections of the terminals. Complementary interengaging pivot means are provided between the actuator and the second legs of the terminals.

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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

5 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 top perspective view of the low profile electrical connector of the invention, with the actuator in open position;

FIGURE 2 is a view similar to that of Figure 1, with the actuator in its closed position;

15 FIGURE 3 is a bottom perspective view of the connector of Figure 2;

FIGURE 4 is a front-to-rear vertical section through the connector, with the actuator in its closed position; and

20 FIGURE 5 is a view similar to that of Figure 4, with the actuator in its open position.

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Detailed Description of the Preferred Embodiment

Referring to the drawings in greater detail, and first to Figures 1-3, the invention is embodied in an electrical connector, generally designated 1, for terminating a flat circuit (not shown). The connector also is adapted for mounting on a printed circuit board (not shown) to interconnect the flat circuit to the board. Generally, connector 1 includes a one-piece housing, generally designated 3, molded of dielectric material such as plastic or the like; an actuator, generally designated 2, pivotally mounted on the housing for movement between an open position (Fig. 1) and a closed position (Figs. 2 and 3); and a plurality of conductive terminals, generally designated 4, spaced laterally at regular intervals in housing 3 beneath actuator 2. In the open position of actuator 2 in Figure 1, an end of a flat circuit, such as a flat flexible circuit, flexible printed circuit board or the like, can be inserted into an elongated opening 5 with zero insertion forces. Actuator 2 then can be pivoted to its closed position shown in Figures 2 and 3 to bias the flat circuit against contact sections of terminals 4, as will be seen hereinafter.

More particularly, dielectric housing 3 has a terminal mounting portion 7 and a pair of cantilever-like arms - 8 projecting forwardly of the terminal mounting portion. The housing has a bottom face 3a and a front end 9. Elongated opening 5 is provided in front end 9, and bottom face 3a is adapted for mounting on a top surface of the printed circuit board. Therefore, the flat circuit can be inserted into opening 5 in a direction generally parallel to bottom face 3a (i.e. generally parallel to the top surface of the printed circuit board). A plurality of terminal-receiving grooves 10 are provided in bottom face 3a of the housing. As seen in Figure 4, each groove 10 communicates with a mounting recess 11 and a terminal-



receiving cavity 12 which open toward bottom face 3a of the housing.

5 Actuator 2 of connector 1 also is a one-piece component which may be molded of dielectric material such as plastic or the like. The actuator includes a generally rectangular plate portion 13 having two operating arms 14. Rectangular plate portion 13 is sized to fit between cantilever-like arms 8 of housing 3. Operating arms 14 are sized to fit within recessed areas 3b of housing 3. 10 Rectangular plate 13 has two cylindrical bosses 15 (Fig. 3) formed at opposite sides of the plate portion for insertion into cylindrical holes (not shown) in the insides of arms 8 of the housing. The cylindrical bosses are effective to rotatably mount the actuator on the housing. Referring to 15 Figure 4 in conjunction with Figures 1 and 2, the actuator also has a plurality of through openings 16 at the top front corner of rectangular plate 13 when the actuator is in its closed position. Openings 16 are aligned with grooves 10, recesses 11 and cavities 12 of housing 3.

20 Referring to Figures 4 and 5, each terminal 4 is stamped from conductive sheet metal material and includes a generally U-shaped portion 4a which defines first and second legs 17 and 19 which are located at opposite sides of elongated opening 5 which receives the flat circuit. 25 Leg 17 is a contact section of the terminal and includes a contact portion 17a for engaging a conductor of the flat circuit. A base 20 extends rearwardly from U-shaped portion 4a of each terminal and includes an upwardly extending mounting section 21 and a rearwardly extending 30 solder tail 22. The solder tail is generally flush with bottom face 3a of housing 3 for connection, as by soldering, to an appropriate circuit trace on the printed circuit board.

35 Terminals 4 are mounted to the bottom of housing 3 of connector 1. In particular, as seen in Figures 4 and



5, the terminals are mounted to the housing in the direction of arrows "A". Mounting sections 21 of the terminals are inserted into mounting recesses 11 of housing 3 by a press-fit to hold the terminals in the housing. When fully mounted, contact portions 17a of the terminals are properly positioned for engaging the conductors of the flat circuit inserted into elongated opening 5 of the housing.

Generally, complementary interengaging pivot means are provided between actuator 2 and terminals 4 to facilitate rotating the actuator between its open and closed positions. More particularly, again referring to Figures 4 and 5, each terminal 4 includes a concave pivot portion 23 at the distal end of upper leg 19 for receiving a pivot cam 24 which has a generally semi-circular pressure surface 24a which seats in concave pivot portions 23 of the terminals. Pivot cam 24 also has a flat surface 26 which faces elongated opening 5 when actuator 3 is in its open position as seen in Figure 5.

In operation of actuator 2, when the actuator is in its open position as shown in Figure 5, flat surface 26 of pivot cam 24 faces opening 5 and allows the flat circuit to be inserted into the opening with zero insertion forces. When the actuator is pivoted to its closed position as shown in Figure 4, semi-circular pressure surface 24a applies pressure to the top of the flat circuit to bias the conductors of the flat circuit into engagement with contact portions 17a of contact sections 17 of the terminals.

Finally, a pair of generally L-shaped securing members or "fitting nails" 27 are provided at the opposite sides of housing 3 to secure the connector to the printed circuit board. Members 27 are fabricated of metal material and can be soldered to selective lands or pads on the printed circuit board, or the members can be bolted to the board to secure the connector to the board.



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 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. An electrical connector (1) for flat circuits, comprising:

5 a low profile housing (3) including a bottom face (3a) and a front end (9) having an elongated opening (5) for receiving an end of a flat circuit inserted into the opening in a direction generally parallel to the bottom face, and a plurality of mounting recesses (11) in the bottom face (3a) of the housing spaced longitudinally along
10 the opening (5); and

a plurality of terminals (4) mounted through the bottom face (3a) of the housing (3) and including mounting sections (21) inserted into said mounting recesses (11), the terminals including contact sections (17) for
15 engagement with appropriate conductors of the flat circuit at said opening.

2. The electrical connector of claim 1 wherein said mounting sections (21) of the terminals (4) are spaced from the contact sections (17) thereof in a direction
20 generally parallel to the bottom face (3a) of the housing (3).

3. The electrical connector of claim 2 wherein said mounting sections of the terminals (4) comprise mounting posts (21) inserted into the mounting recesses
25 (11) in the bottom face (3a) of the housing.

4. The electrical connector of claim 1 wherein said bottom face (3a) of the housing (3) is adapted for mounting on a top surface of a printed circuit board.

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5 5. The electrical connector of claim 4 wherein said terminals (4) include tail sections (22) generally flush with the bottom face (3a) of the housing (3) for connection to appropriate circuit traces on the printed circuit board.

 6. The electrical connector of claim 1 wherein said contact section of each terminal comprises one leg (17) of a generally U-shaped portion (4a) of the terminal (4).

10 7. The electrical connector of claim 6 wherein said one leg (17) is located at one side of said elongated opening (5), and a second leg (19) of the generally U-shaped portion (4a) of each terminal (4) is located at an opposite side of the elongated opening.

15 8. The electrical connector of claim 7, including an actuator (2) movably mounted on the housing (3) for biasing the flat circuit against said one legs (17) which comprise the contact sections of the terminals (4).

20 9. The electrical connector of claim 8, including complementary interengaging pivot means (23,24) between the actuator (2) and said second legs (19) of the terminals (4).



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10. An electrical connector (1) for flat circuits, comprising:

5 a low profile housing (3) including a bottom face (3a) adapted for mounting on a top surface of a printed circuit board and a front end (9) having an elongated opening (5) for receiving an end of a flat circuit inserted into the opening in a direction generally parallel to the bottom face (3a), and a plurality of mounting recesses (11) in the bottom face of the housing spaced longitudinally along the opening (5); and

10 a plurality of terminals (4) mounted through the bottom face (3a) of the housing (3) and including mounting posts (21) inserted into said mounting recesses (11), contact sections (17) for engagement with appropriate conductors of the flat circuit at said opening (5), tail sections (22) generally flush with the bottom face (3a) of the housing for connection to appropriate circuit traces on the printed circuit board, and the mounting posts (21) of the terminals (3) being spaced from the contact sections (17) thereof in a direction generally parallel to the bottom face (3a) of the housing.

11. The electrical connector of claim 10 wherein said contact section of each terminal comprises one leg (17) of a generally U-shaped portion (4a) of the terminal (4).

12. The electrical connector of claim 11 wherein said one leg (17) is located at one side of said elongated opening (5), and a second leg (19) of the generally U-shaped portion (4a) of each terminal (4) is located at an opposite side of the elongated opening.

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13. The electrical connector of claim 12, including an actuator (2) movably mounted on the housing (3) for biasing the flat circuit against said one legs (17) which comprise the contact sections of the terminals (4).

5 14. The electrical connector of claim 13, including complementary interengaging pivot means (23,24) between the actuator (2) and said second legs (19) of the terminals (4).



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