

Description

This invention relates to electrical connectors which can be mounted on a circuit board, and particularly to improved mounting means for such connections

In the manufacture of electronic equipment, it is frequently required that electrical connectors be mounted on a circuit board. Various known mounting methods provide a connector with posts that are intended to fit snugly into holes on a circuit board. However, the known methods do not adequately provide a sturdy, secure and reliable mounting system that properly compensates for slight variation in the diameter of the holes of the circuit board.

US-A-4195 900 describes an electrical connector adapted to be mounted on a circuit board. The invention provides a connector which, as is known from US-A-4195 900, has each of said legs adapted to fit snugly to a corresponding mounting hole on said circuit board. Each leg has a cross-section perpendicular to its longitudinal axis which is a closed geometric shape having a major axis substantially perpendicular to a minor axis, the length of said major axis being greater than the diameter of the corresponding mounting hole*in the circuit board and the length of the minor axis being somewhat less than the diameter of the corresponding mounting hole in the circuit board. In accordance with the invention, and in contrast to US-A-4 195 900, the legs are diamond-shaped in cross-section.

A connector constructed in accordance with the invention is provided with these uniquely shaped legs or projections which are adapted to be fitted into the holes of a circuit board so as to provide a secure and reliable press fit. A connector of this invention may adopt a unique method of making electrical contact with the electrically conductive elements of the circuit board so that there is no need for plated through holes in the circuit board.

The greater length of the major axis of each leg provides for a tight fit when the leg is forced into a hole in the circuit board. Of course, the length should not be so great that the leg cannot be forced into such a hole. Preferably, the length of the major axis is not more than about 5% greater (more preferably, not more than about 2% greater) than the diameter of the hole in the circuit board into which the leg is to be inserted. It is especially preferred that the lowermost portions of each leg be slightly tapered at the ends of the major axis so that each leg may be more readily forced into its corresponding mounting hole. The length of the minor axis is somewhat less than that of the diameter of the hole in the circuit board into which the leg is to be inserted. This allows for misalignment of the hole pattern relative to the leg pattern. Preferably,

the length of the minor axis is about 30% smaller (more preferably, about 34% smaller) than the diameter of the hole in the circuit board into which the leg is to be inserted.

The major axis of the first leg may be oriented parallel or perpendicular to the major axis of the second leg. A parallel orientation allows for better alignment of the connector to the hole pattern. The perpendicular orientation, which is preferred, allows for better resistance of the connector to being wiggled loose out of the board.

The connectors of this invention can be made in vertical and horizontal entry styles. Both the vertical and horizontal styles use the same press fit legs designs described above. The vertical style receives a modular plug inserted in a direction that is perpendicular to the circuit board on which the connector is mounted. The horizontal style receives a modular plug that is inserted in a direction that is parallel to the plane of the circuit board. Both the vertical and horizontal entry style connectors can be made with varying numbers of contact wires. The most commonly used numbers of contact wires are four, six or eight. The number of contacts and the spacing of these contacts will depend on the desired application.

In one embodiment of the invention, a horizontal entry style connector of the present invention is provided with contacts that engage the surface of the circuit board. Such surface mounting of the contacts eliminates the need for plated through holes in the circuit board. The contact wires have spring characteristics which cause them to press firmly against the circuit board. The terminal portions of the contact wires can be soldered to the board using vapor phase reflow soldering. This is made possible by manufacturing the connector from a high temperature resistant plastic. When a surface mounting arrangement is desired, the contact wires in the connector go through one bend of about 135° and one bend of about 90° within the connector. The contact wires then exit the connector and a short portion at about a 90° angle to the portion of the contact wire that leads out of the connector comes in contact with the circuit board.

In one embodiment of the invention, the body of a connector, which may be a horizontal entry style or a vertical entry style, is made of plastic and the contact wires of the connector lie within grooves in the connector. Ultrasonic energy is then used to melt a portion of the upper walls of the grooves across the surface of the contact wires so that the wires are held firmly in place. As this procedure reduces the spring characteristics of the contact wires, this is generally not done if surface mounting of the contact wires is desired.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more detailed understanding of the invention and for an illustration of preferred embodiments thereof, reference is made to the drawings in which:-

Figure 1 is a bottom plan view of a horizontal entry style modular jack which is a connector of the present invention;

Figure 2 is a perspective view of the modular jack of Figure 1;

Figure 3 is a cut-away view of the modular jack shown in Figure 2;

Figure 4 is a fragmentary cross-sectional view taken along the line 4-4 of Figure 2;

Figure 5 is a side view showing the modular jack of Figure 2 affixed to a circuit board;

Figure 6 is a side view of an alternative embodiment of the invention wherein a horizontal entry style modular jack has contact wires intended for surface mounting;

Figure 7 is a bottom plan view of the modular jack shown in Figure 6;

Figure 8 is a top plan view of a vertical entry style modular jack of the present invention;

Figure 9 is a vertical cross-sectional view taken along the line 9-9 of Figure 8;

Figure 10 is a side view of the modular jack of Figure 8 taken along the lines 10-10 of Figure 9; and

Figure 11 is a bottom plan view of the modular jack of Figure 8 taken along the lines 11-11 of Figure 10.

DESCRIPTION OF PREFERRED EMBODIMENTS

In the Figures, parts which have the same or a similar function are assigned the same identifying number.

Figure 1 shows a horizontal entry modular jack 1 having diamond shaped legs 2 and 3 oriented perpendicular to each other. These diamond shaped legs are oriented so that the major axis of leg 2 is oriented perpendicularly to the major axis of leg 3 and the legs are adapted to be inserted into corresponding circular holes in a circuit board. The bottommost portions of the legs are tapered at either end of the major axis of each leg, so that they can more readily be forced into corresponding holes in the circuit board. An alternate orientation of legs 2 and 3 in which the major axis of one leg is oriented parallel to that of the second leg is shown in Figure 7.

Figure 2 shows additional features of jack 1. Jack 1 has an aperture 4 into which a modular plug may be inserted. Other features are discussed below.

As shown in Figure 3, jack 1 has several contact wires, each of which runs within a channel in the jack and has two bends within the jack. For

example, contact wire 5 runs in channel 6. Each contact wire is held firmly by being inserted into a hole in the base of the jack.

The contact wires extend downward from the bottom surface of jack 1 and are inserted into plated through holes in a circuit board (see, for example, hole 7 in Figure 5). Alternatively, as shown in Figures 6 and 7 for jack 8, the wires are bent at a 90° angle so that the terminal portion of each contact wire is in contact with the top surface of the circuit board.

When the contact wires of the jack are designed to extend directly down into plated holes on a circuit board, the contact wires may be secured more firmly within the grooves of the jack by ultrasonically melting some plastic from the walls of the grooves along a portion of each contact wire and then allowing the plastic to solidify so that each contact wire is held in place by plastic as shown in Figure 4. This may be done with an apparatus such as an XL ultrasonic assembly system, manufactured by Branson Sonic Power of Danbury, Connecticut.

The modular jacks shown in the Figures also have projections (see, for example, 9, 10, 11, 12, and 16, shown in Figure 1, and 13 shown in both Figure 1 and Figure 2) and apertures (see, for example, 14 and 15 shown in Figure 1). Projections 9, 10, 11 and 12 serve as standoffs which allow clearance for cleaning the circuit board after the contact wires are soldered to the circuit board. Projections 13 and 16 are mounting ears around which a recess in the user's cabinet can be designed. The recess traps the jack by the use of the ears so the jack is well supported. Apertures 14 and 15 result because tooling in the mold used to form connector 1 protrudes through the bottom of the connector resulting in two voids when the connector is formed. In Figure 1, the interior of jack 1, including portions of the contact wires, is visible through apertures 14 and 15.

Figures 8-11 show a vertical entry modular jack 17. The jack is similar in construction to horizontal entry modular jack 1 described above except that it is designed so that a modular plug may be inserted into the top of the jack (i.e. into aperture 18) rather than into one side of the jack.

Claims

1. An electrical connector adapted to be mounted on a circuit board, said connector having at least two legs (2, 3), each of said legs being adapted to fit snugly into a corresponding mounting hole on said circuit board, each leg having a cross-section perpendicular to its longitudinal axis which is a closed geometric shape having a major axis substantially per-

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Claims

1. An electrical connector adapted to be mounted on a circuit board, said connector having at least two legs (2, 3), each of said legs being adapted to fit snugly into a corresponding mounting hole on said circuit board, each leg having a cross-section perpendicular to its longitudinal axis which is a closed geometric shape having a major axis substantially per-



- pendicular to a minor axis, the length of said major axis being greater than the diameter of the corresponding mounting hole in the circuit board and the length of the minor axis being somewhat less than the diameter of the corresponding mounting hole in the circuit board; characterised in that the legs are diamond shaped in cross-section.
2. The connector of claim 1, wherein the major axis of at least one of said legs is oriented perpendicular to the major axis of another of said legs.
 3. The connector of claim 1, wherein the major axis of at least one of said legs is oriented parallel to the major axis of another of said legs.
 4. The connector of any of the preceding claims, wherein the length of the major axis is not more than 5% greater than the diameter of the corresponding hole in the circuit board.
 5. The connector of any of the preceding claims, wherein the length of the minor axis is at least 30% smaller than the diameter of the corresponding hole in the circuit board.
 6. The connector of any one of the preceding claims, wherein each leg has a bottom portion tapered at the ends of the major axis.
 7. The connector of any one of the preceding claims, wherein contact wires (5) exit the connector in a direction that is substantially perpendicular to the plane of the bottom of the connector and are bent at a 90° angle so that they are adapted to make surface contact with the surface of the circuit board.
 8. The connector of any one of claims 1 to 7 and further comprising an insulating housing and a plurality of electrical conductors disposed in side-by-side, spaced-apart relationship, said conductors having terminal portions which extend downward from a bottom surface of said housing and are adapted for electrical contact with said circuit board.
 9. The connector of claim 9, wherein the terminal portions of said conductors are inserted into plated-through holes of said circuit board when the connector is mounted on said board.
 10. The connector of claim 9, wherein the terminal portions of said conductors extend substantially perpendicular to the plane of said bottom surface of the connector housing, and are bent at a 90° angle so that the conductors are adapted to make surface contact with the surface of the circuit board.
 11. The connector of claim 10, wherein the bent terminal portions of said conductors are spring-like, enabling them to press firmly against said circuit board.
 12. The connector of any one of claims 8 to 11, wherein the insulating housing of said connector is formed of a high temperature resistant plastic and said conductors are soldered to the circuit board by vapor phase reflow soldering.
 13. The connector of any one of claims 8 to 11, wherein the housing is formed of plastic and has grooves formed along one surface thereof, said conductors extending in said grooves and being secured more firmly therein by ultrasonically melting some of the plastic of said grooves around a portion of said conductors.
 14. The connector of any one of claims 8 to 13, wherein the conductors are contact wires.
 15. The connector of any one of the preceding claims, wherein the connector is a modular jack and is adapted to receive a modular plug which is inserted in a direction perpendicular to the circuit board.
 16. The connector of any one of claims 1 to 14, wherein the connector is a modular jack and is adapted to receive a modular plug which is inserted in a direction parallel to the circuit board.

Revendications

1. Un connecteur électrique destiné à être monté sur une plaquette de circuits imprimés, ledit connecteur étant muni d'au moins deux pieds ou branches (2, 3), dont chacun est susceptible d'être monté de façon ajustée dans un trou de montage correspondant sur ladite plaquette de circuits imprimés, chaque pied présentant une section transversale perpendiculairement à son axe longitudinal qui constitue une forme géométrique fermée, présentant un grand axe sensiblement perpendiculaire à un petit axe, la longueur dudit grand axe étant supérieure au diamètre du trou de montage correspondant sur la plaquette de circuits imprimés, et la longueur du petit axe étant quelque peu inférieure au diamètre du trou de montage correspondant sur la plaquette de circuits imprimés;



caractérisé en ce que les pieds présentent une section transversale en forme de pointes de diamant ou rhombique.

2. Le connecteur selon la revendication 1, dans lequel le grand axe d'au moins l'un desdits pieds est orienté perpendiculairement au grand axe d'un autre desdits pieds. 5
3. Le connecteur selon la revendication 1, dans lequel le grand axe d'au moins un desdits pieds est orienté parallèlement au grand axe d'un autre desdits pieds. 10
4. Le connecteur selon l'une quelconque des revendications précédentes, dans lequel la longueur du grand axe n'est pas supérieure de plus de 5% au diamètre du trou correspondant dans la plaquette de circuits imprimés. 15
5. Le connecteur selon l'une quelconque des revendications précédentes, dans lequel la longueur du petit axe est au moins inférieure de 30% au diamètre du trou correspondant dans la plaquette de circuits imprimés. 20
6. Le connecteur selon l'une quelconque des revendications précédentes, dans lequel chaque pied présente une partie inférieure effilée aux extrémités du grand axe. 30
7. Le connecteur selon l'une quelconque des revendications précédentes, dans lequel des fils de contact (5) sortent du connecteur dans une direction qui est sensiblement perpendiculaire au plan du fond du connecteur, et sont cambrés selon un angle à 90° , de sorte qu'ils sont susceptibles d'établir un contact de surface avec la surface de la plaquette de circuits imprimés. 35
8. Le connecteur selon l'une quelconque des revendications 1 à 7, comprenant en outre un boîtier isolant et une pluralité de conducteurs électriques disposés côte à côte, espacés les uns des autres, lesdits conducteurs présentant des parties d'extrémité qui s'étendent vers le bas à partir d'une surface inférieure dudit boîtier, et qui sont susceptibles d'établir un contact électrique avec ladite plaquette de circuits imprimés. 40
9. Le connecteur selon la revendication 9, dans lequel les parties d'extrémité desdits conducteurs sont insérées dans des trous traversants métallisés de ladite plaquette de circuits imprimés lorsque le connecteur est monté sur ladite plaquette. 45

10. Le connecteur selon la revendication 9, dans lequel les parties d'extrémité desdits conducteurs s'étendent de façon sensiblement perpendiculaire au plan de ladite surface inférieure du boîtier du connecteur, et sont cambrées selon un angle à 90° , de sorte que les conducteurs soient susceptibles d'établir un contact de surface avec la surface de la plaquette de circuits imprimés. 50

11. Le connecteur selon la revendication 10, dans lequel les parties d'extrémité cambrées desdits conducteurs sont en forme de ressort, pour leur permettre de presser fermement contre ladite plaquette de circuits imprimés. 55

12. Le connecteur selon l'une quelconque des revendications 8 à 11, dans lequel le boîtier isolant dudit connecteur est réalisé en matière plastique résistant à des températures élevées, et lesdits conducteurs sont brasés à la plaquette de circuits imprimés par un brasage par refusion en phase vapeur. 60

13. Le connecteur selon l'une quelconque des revendications 8 à 11, dans lequel le boîtier est réalisé en matière plastique et présente des rainures formées le long de l'une de ses surfaces, lesdits conducteurs s'étendant dans lesdites rainures et étant fixées plus fermement à l'intérieur en faisant fondre aux ultrasons un peu de la matière plastique desdites rainures, autour d'une partie desdits conducteurs. 65

14. Le connecteur selon l'une quelconque des revendications 8 à 13, dans lequel les conducteurs sont des fils de contact. 70

15. Le connecteur selon l'une quelconque des revendications précédentes, dans lequel le connecteur est une douille modulaire et est susceptible de recevoir une fiche modulaire qui est insérée dans une direction perpendiculaire à la plaquette de circuits imprimés. 75

16. Le connecteur selon l'une quelconque des revendications 1 à 14, dans lequel le connecteur est une douille modulaire et est susceptible de recevoir une fiche modulaire qui est insérée dans une direction parallèle à la plaquette de circuits imprimés. 80

Patentansprüche

1. Elektrischer Steckverbinder, welcher derart ausgelegt ist, daß er an einer Schaltungsplatte angebracht werden kann, wobei der Verbinder wenigstens zwei Schenkel (2,3) hat, jeder 55



- Schenkel derart ausgelegt ist, daß er passend eng in einer zugeordneten Befestigungsöffnung an der Schaltungskarte anordenbar ist, wobei jeder Schenkel einen Querschnitt senkrecht zur Längsachse hat, der eine geschlossene, geometrische Gestalt mit einer Hauptachse hat, die im wesentlichen senkrecht zu einer Nebenachse ist, wobei die Länge der Hauptachse größer als der Durchmesser der zugeordneten Befestigungsöffnung in der Schaltungskarte ist und die Länge der Nebenachse etwas kleiner als der Durchmesser der zugeordneten Befestigungsöffnung der Schaltungskarte ist, dadurch **gekennzeichnet**, daß die Schenkel im Querschnitt rautenförmig ausgebildet sind.
2. Verbinder nach Anspruch 1, bei dem die Hauptachse wenigstens eines Schenkels senkrecht zu der Hauptachse des anderen Schenkels ausgerichtet ist.
 3. Verbinder nach Anspruch 1, bei dem die Hauptachse wenigstens eines Schenkels parallel zur Hauptachse des anderen Schenkels ausgerichtet ist.
 4. Verbinder nach einem der vorangehenden Ansprüche, bei dem die Länge der Hauptachse um nicht mehr als 5% grösser als der Durchmesser der zugeordneten Öffnung in der Schaltungskarte ist.
 5. Verbinder nach einem der vorangehenden Ansprüche, bei dem die Länge der Nebenachse wenigstens 30% kleiner als der Durchmesser der zugeordneten Öffnung in der Schaltungskarte ist.
 6. Verbinder nach einem der vorangehenden Ansprüche, bei dem jeder Schenkel einen Bodenabschnitt hat, der an den Enden der Hauptachse konisch ausgebildet ist.
 7. Verbinder nach einem der vorangehenden Ansprüche, bei dem die Kontaktdrähte (5) den Verbinder in einer Richtung verlassen, die im wesentlichen senkrecht zu der Bodenebene des Verbinders ist und bei dem die Kontaktdrähte unter einem Winkel von 90° derart gebogen sind, daß sie mit der Oberfläche der Schaltungskarte einen Flächenkontakt schließen können.
 8. Verbinder nach einem der Ansprüche 1 bis 7, welcher ferner ein Isoliergehäuse und eine Mehrzahl von elektrischen Leitern aufweist, die nebeneinander liegend und im Abstand zueinander in demselben angeordnet sind, wobei die Leiter Anschlußabschnitte haben, die von einer Bodenfläche des Gehäuses nach unten verlaufen und derart ausgelegt sind, daß sie einen elektrischen Kontakt mit der Schaltungskarte schließen.
 9. Verbinder nach Anspruch 8, bei dem die Anschlußabschnitte der Leiter in plattierte Durchgangsöffnungen der Schaltungskarte eingeführt sind, wenn der Verbinder an der Karte angebracht ist.
 10. Verbinder nach Anspruch 9, bei dem die Anschlußabschnitte der Leiter im wesentlichen senkrecht zur Grundflächenebene des Verbindergehäuses verlaufen und unter einem Winkel von 90° derart gebogen sind, daß die Leiter einen Flächenkontakt mit der Oberfläche der Schaltungskarte schließen können.
 11. Verbinder nach Anspruch 10, bei dem die gebogenen Anschlußabschnitte der Leiter federähnlich ausgebildet sind und ermöglichen, daß sie fest gegen die Schaltungskarte gepreßt werden.
 12. Verbinder nach einem der Ansprüche 8 bis 11, bei dem das Isoliergehäuse des Verbinders aus einem hochtemperaturbeständigen Kunststoff ausgebildet ist und die Leiter an der Schaltungskarte mittels Dampfphasenlötens angelötet sind.
 13. Verbinder nach einem der Ansprüche 8 bis 11, bei dem das Gehäuse aus einem Kunststoff ausgebildet ist und Ausnehmungen hat, die längs einer Fläche ausgebildet sind, wobei die Leiter in den Ausnehmungen verlaufen und in denselben mittels Ultraschallschmelzen des Kunststoffs der Ausnehmungen um einen Teil der Leiter festgelegt sind.
 14. Verbinder nach einem der Ansprüche 8 bis 13, bei dem die Leiter Kontaktdrähte sind.
 15. Verbinder nach einem der vorangehenden Ansprüche, bei dem der Verbinder eine modulare Buchse und derart ausgelegt ist, daß ein modularer Stecker aufgenommen werden kann, der in eine Richtung senkrecht zur Schaltungsplatte eingeführt wird.
 16. Verbinder nach einem der Ansprüche 1 bis 14, bei dem der Verbinder eine modulare Buchse und derart ausgelegt ist, daß ein modularer Stecker aufgenommen werden kann, der in eine Richtung parallel zur Schaltungsplatte ein-



geführt wird.

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