

An electrical terminal and an edgecard connector incorporating the same

This invention relates to an electrical terminal, particularly for an edgecard connector for use in the electrical connector industry, for example in microcircuits technology involving multiple circuit board terminations. More particularly, this invention relates to elongate terminals which are press fit into circuit board aperture and which have spring arm contacts adapted for receiving and making electrical contact with circuit boards.

In the use of terminals for microcircuit applications there is an ever-present need for structures which are inexpensive to manufacture, yet which possess inherently high degrees of reliability. In the manufacture of press-fit terminals for mounting in circuit board apertures, care must be exercised to insure that tolerances between the board apertures and the mounting portions of the terminals are within certain preset limits. The limits must be adequate to insure sufficient retention force, and yet avoid injury to metallization plating in the aperture. Many structures have been proposed for achievement of this objective without substantial sacrifice in manufacturing costs and reliability of the terminations effected thereby.

For example, U.S. 4,066,326, discloses a circuit board contact with an expanded mounting portion which will maintain a desired retention force over a large circuit board aperture tolerance. Circuit board terminals having similar deformed mounting portions are also described in U.S. 3,827,004 issued to Vanden Heuvel et al. and U.S. 3,634,819 issued to Evans. These structures, although quite sufficient for their intended purposes, do not provide sufficient retention force without solder bonding when utilized in conjunction with wire wrap tail contacts wherein the terminal may be subjected to substantial torsional forces. Additionally, some of the prior art structures (e.g., U.S. 3,634,819) designed for high force retention do not sufficiently insure accurate location of the central axis of the mounting portion within the circuit board aperture upon termination.

US-A-4,057,315 discloses an elongate electrical terminal for press fitting in a circuit board aperture, having a contact at each end and a mounting portion (16) therebetween, said mounting portion comprising a generally cylindrical body having voids impressed therein, the body having a generally bow-tie shaped cross-section with convex surfaces at its ends and impressions formed in its sides by said voids to define reduced centre portions in said cross-section.

Press-fit terminals with spring arm contacts are often used in edgecard connectors. Unfortunately, such connectors built to provide high normal forces have been associated with

undesirably high insertion forces, as most of them utilize cantilever spring arm systems. In order to provide satisfactory mating between the board and spring arms, a sufficient normal force must be created to assure firm electrical contact, but high board insertion forces must be avoided. The typical edgecard connector contains parallel opposing rows of terminals having spring arm contacts biased toward each other so as to define a convex contact engaging surface for a mating board. The spring arms function as cantilever beams, so that when a board is slidably inserted therebetween, the ends of the spring arms are forced laterally apart. Thus, the higher the normal force provided, the greater the insertion force. Various structures have been proposed for achieving a reduced insertion force per a given normal force, but many do so only marginally, and most involve the technique of preloading the opposing spring arm contacts as disclosed in U.S. 3,963,293 issued to McKee and U.S. 3,671,917 issued to Ammon et al. Therefore, the spring arm contacts should have a high retention force when mounted in the connector, without damaging the board.

U.S. 3,864,014 discloses an edgecard connector which comprises a plurality of elongate terminals each having a contact at both ends and a deformable mounting portion therebetween, said mounting portions being a press fit into apertures in a supporting circuit board, one of said contacts of each terminal being a spring arm having a free end, the second of said contacts being a wire wrap tail, and an insulative housing mated with said supporting circuit board, said housing having means to removably receive, edgewise, a mating circuit board, and being adapted to fit over the spring arm contacts of said plurality of terminals, the terminals being positioned in opposing rows in said apertures of the supporting circuit board, the housing having a well therein substantially parallel to the axes of the wire wrap tails of inserted terminals, the wall being adapted to restrict the free ends of the spring arms to movement only along a plane parallel to the axes of said tails when a mating circuit board is inserted into the connector.

Viewed from one aspect the present invention provides an elongate electrical terminal for press fitting in a circuit board aperture, having a contact at each end and a mounting portion therebetween, said mounting portion comprising a generally cylindrical body having voids impressed therein, the body having a generally bow-tie shaped cross-section with convex surfaces at its ends and impressions formed in its sides by said voids to define reduced centre portions in said cross-section, characterised in that the voids are generally oval-shaped, that the major axes of said voids

(12)

extend parallel to the longitudinal axis of said body, that the impressions are symmetrically opposed and dish-shaped and in that said mounting portion as a result of the impressions therein, is deformable upon press fitting into a round circuit board aperture so as to have the convex surfaces at each end of the bow-tie shaped cross-section in intimate contact with the inside surface of said round aperture whereby said reduced centre portion plastically deforms and/or shears.

Viewed from another aspect the invention provides an edgcard connector which constitutes an improvement over that disclosed in U.S. 3,864,014 in that the said mounting portion of each terminal has a generally cylindrical body with symmetrically opposed generally oval-shaped voids impressed therein, the major axes of said voids extending parallel to the longitudinal axis of said body, the body having a generally bow-tie shaped cross-section with symmetrically opposed dish-shaped impressions formed therein by said voids to define a reduced centre portion in said cross-section, the reduced portion of said cross-section of said mounting portion being adapted to be plastically deformed and/or sheared upon the press fitting of said mounting portion into a circuit board aperture.

The elongate press-fit terminal of this invention has a mounting portion which provides a high retention force under torsional stress without solder bonding. The mounting portion also provides accurate central axis location in a circuit board aperture. The edgcard connector of this invention provides a high normal force.

Some embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which:

Figure 1 is a side elevation view of a press-fit terminal of this invention attached to a carrier strip;

Figure 2 is a front elevation view of the press-fit terminal of Figure 1, including two such terminals attached to a carrier strip;

Figure 3 is a front elevation view of the deformed mounting portion of the terminal;

Figure 4 is a cross-section view of the deformed mounting portion of the terminal;

Figure 5 is a cross-section view of the deformed mounting portion after being press fitted into a circuit board aperture;

Figure 6 is a broken perspective view of an alternate embodiment of the mounting portion of the terminal;

Figure 7 is an exploded perspective view of an edgcard connector of this invention which utilizes the terminal of Figures 1 and 2;

Figure 8 is a side elevation sectional view of the edgcard connector which shows a pair of opposed terminals positioned therein; and

Figure 9 is a side elevation sectional view of

the connector which depicts flexure positions of the spring arm contact of the terminal.

An elongate terminal 10 according to this invention is shown in Figures 1 and 2. The terminal has a bifurcated spring arm contact 12 at one end and a wire wrap tail contact 14 at the other. Intermediate the contacts is a deformed mounting portion 16 adapted for press fitting into an aperture in a printed circuit board. Intermediate the spring arm contact and the mounting portion is a first shoulder 18, a neck 20, and a second shoulder 22. The terminal 10 is integrally attached to a carrier strip 24 from which it is severed at reduced section 26 for press fitting into a circuit board aperture. The spring arm contact 12 when severed from a carrier strip has a free end 15 parallel to and offset from the axis 17 of the wire wrap tail 14 as may be observed in Figure 1. The offset feature, however, is not essential to the operability of this invention.

Figure 3 is an enlarged view of the mounting portion 16 of the terminal 10. The body of the mounting portion 16 is generally cylindrical with symmetrically opposed oval-shaped voids 28 impressed therein by a die. The major axes 30 of the oval voids extend parallel to the longitudinal axis 32 of the mounting portion 16. The cross-section 34 of the mounting portion 16 is shown in Figure 4. It is generally bow-tie shaped with symmetrically opposed dish-shaped sections 36 formed by the voids 28 to form a reduced centre portion 38. The reduced center portion 38 is designed to plastically deform upon the press fitting of the mounting portion 16 into a circuit board aperture 40 as shown in Figure 5. Deformation of the center portion 38 occurs prior to the realization of injurious pressure fitting forces. Thus, referring to Figure 5, the pressure exerted by the contact surface 42 of the mounting portion 16 against the metallization plating 44 in the aperture is thereby controlled to avoid (1) injury to the plating 44, and (2) extreme deformation of the aperture 40. At the same time, the contact surface 42 is large enough to afford high rates of retention force without solder bonding in terminations subjected to substantial torsional forces as, for example those encountered in the use of wire wrap tails.

Although the mounting portion of this invention provides a high retention force without solder bonding, the application of solder may be utilized for an even higher retention force. Thus, Figure 6 is a broken perspective view of an alternate embodiment of the mounting portion 16 in a cross section of the aperture 40. A mass of solder 46, shown as a globule, is contained within a support hole 48 formed within the shoulder 22 of the terminal. As the shoulder 22 is contiguous with the mounting portion 16, the mass of solder is positioned so as to flow into interspaces 50 (Fig. 5) between inserted mounting portion 16

and the aperture 40 upon exposure to an external heat source, such as infrared heater.

The elongate terminal 10 of this invention is adapted for use in an edgcard connector 60 as shown in Figures 7 and 8.

Figure 7 is an exploded perspective view of the connector 60 which contains a plurality of the terminals 10. The terminals are press fit into apertures 40 in a supporting circuit board 52 in opposing parallel rows as shown. An insulative housing 70 fits over the spring arm contacts 12 of the terminals 10 and is mated with the supporting board 52 by mechanical fasteners not shown. The housing 70 has an opening 72 adapted for removably receiving a mating circuit board 80 in edgewise fashion as depicted.

The circuit board 80 has metallization pads 82 printed thereon by conventional screen printing techniques. The pads 82 are electrically connected to other electrical elements, not shown. The edgcard connector 60 provides a mechanism by which mechanical and electrical contact may be achieved between the metallization pads 82 and the spring arm contacts 12 contained within the housing 70.

Figure 8 is an elevation sectional view of the assembled edgcard connector 60 which shows a pair of opposed terminals 10 positioned within the housing 70 for receiving mating circuit board 80. The housing 70 has an internal wall 74 parallel to the axes 17 of the wire wrap tails 14 of inserted terminals 10.

In Figure 9, one of the spring arms 12 is shown in both unflexed and flexed positions (the latter in phantom). The free end 15 of the spring arm 12 maintains contact with the wall 74 in both positions shown as well as between positions. The wall restricts the free end 15 to slidable movement along a plane parallel to the axis 17 of the wire wrap tail 14 of an inserted terminal 10. The spring arm 12 functions therefore as a leaf spring instead of the typical cantilever spring used in most edgcard connectors. Thus, as seen in Figure 8, since the free ends 15 of the spring arms 12 cannot move laterally, they will not be forced apart upon insertion of a mating board so as to produce the high rates of insertion forces associated with cantilever systems. Rather, a much lower insertion force is realized for a given normal force value in the leaf spring system.

The press-fit terminal and edgcard connector of this invention have wide applicability in micro-circuits applications involving electrical terminations between circuit boards. For example, such devices are mounted in electronic backplanes of computers telephonic switching gear, and many other low voltage signal systems.

It should be noted that the reduced centre portion 38 of the mounting portion 16 of the terminal may be adapted to shear upon press fitting in a circuit board aperture, rather than only plastically deforming as described above,

with little or no reduction in the advantages already set forth.

Claims

1. An elongate electrical terminal (10) for press fitting in a circuit board aperture (40), having a contact (12, 14) at each end and a mounting portion (16) therebetween, said mounting portion comprising a generally cylindrical body having voids (28) impressed therein, the body having a generally bow-tie shaped cross-section with convex surfaces (42) at its ends and impressions (36) formed in its sides by said voids to define reduced centre portions (38) in said cross-section, characterised in that the voids (28) are generally oval-shaped, that the major axes (30) of said voids extend parallel to the longitudinal axis (32) of said body, that the impressions (36) are symmetrically opposed and dish-shaped and in that said mounting portion (16) as a result of the impressions (36) therein, is deformable upon press fitting into a round circuit board aperture (40) so as to have the convex surfaces (42) at each end of the bow-tie shaped cross-section in intimate contact with the inside surface of said round aperture (40) whereby said reduced centre portion (38) plastically deforms and/or shears.

2. A terminal as claimed in claim 1, which has a mass of solder (46) adjacent said mounting portion (16), said mass of solder being positioned so as to flow, upon exposure to an external heat source, into interspaces (50) between an inserted mounting portion (16) and a corresponding circuit board aperture (40).

3. A terminal as claimed in claim 1 or 2, wherein one of said contacts is a spring arm (12) in line with the axis of the terminal (32).

4. A terminal as claimed in claim 1 or 2, wherein one of said contacts is a wire wrap tail (14), the other being a spring arm (12) having a free end (15) parallel to and offset from the axis (17) of the wire wrap tail.

5. A terminal as claimed in claim 4, wherein said spring arm contact (12) is bifurcated, said terminal (10) having a first shoulder (18), a neck portion (20), and a second shoulder (22) all positioned intermediate said spring arm contact (12) and said mounting portion (16).

6. An edgcard connector (60) which comprises:

(a) a plurality of elongate terminal (10) each having a contact (12, 14) at both ends and a deformable mounting portion (16) therebetween, said mounting portions being a press fit into apertures (40) in a supporting circuit board (52), one of said contacts of each terminal being a spring arm (12) having a free end (15), the second of said contacts being a wire wrap tail (14),

(b) an insulative housing (70) mated with said supporting circuit board (52), said housing

and the aperture 40 upon exposure to an external heat source, such as infrared heater.

The elongate terminal 10 of this invention is adapted for use in an edgcard connector 60 as shown in Figures 7 and 8.

Figure 7 is an exploded perspective view of the connector 60 which contains a plurality of the terminals 10. The terminals are press fit into apertures 40 in a supporting circuit board 52 in opposing parallel rows as shown. An insulative housing 70 fits over the spring arm contacts 12 of the terminals 10 and is mated with the supporting board 52 by mechanical fasteners not shown. The housing 70 has an opening 72 adapted for removably receiving a mating circuit board 80 in edgewise fashion as depicted.

The circuit board 80 has metallization pads 82 printed thereon by conventional screen printing techniques. The pads 82 are electrically connected to other electrical elements, not shown. The edgcard connector 60 provides a mechanism by which mechanical and electrical contact may be achieved between the metallization pads 82 and the spring arm contacts 12 contained within the housing 70.

Figure 8 is an elevation sectional view of the assembled edgcard connector 60 which shows a pair of opposed terminals 10 positioned within the housing 70 for receiving mating circuit board 80. The housing 70 has an internal wall 74 parallel to the axes 17 of the wire wrap tails 14 of inserted terminals 10.

In Figure 9, one of the spring arms 12 is shown in both unflexed and flexed positions (the latter in phantom). The free end 15 of the spring arm 12 maintains contact with the wall 74 in both positions shown as well as between positions. The wall restricts the free end 15 to slidable movement along a plane parallel to the axis 17 of the wire wrap tail 14 of an inserted terminal 10. The spring arm 12 functions therefore as a leaf spring instead of the typical cantilever spring used in most edgcard connectors. Thus, as seen in Figure 8, since the free ends 15 of the spring arms 12 cannot move laterally, they will not be forced apart upon insertion of a mating board so as to produce the high rates of insertion forces associated with cantilever systems. Rather, a much lower insertion force is realized for a given normal force value in the leaf spring system.

The press-fit terminal and edgcard connector of this invention have wide applicability in micro-circuits applications involving electrical terminations between circuit boards. For example, such devices are mounted in electronic backplanes of computers telephonic switching gear, and many other low voltage signal systems.

It should be noted that the reduced centre portion 38 of the mounting portion 16 of the terminal may be adapted to shear upon press fitting in a circuit board aperture, rather than only plastically deforming as described above,

with little or no reduction in the advantages already set forth.

Claims

1. An elongate electrical terminal (10) for press fitting in a circuit board aperture (40), having a contact (12, 14) at each end and a mounting portion (16) therebetween, said mounting portion comprising a generally cylindrical body having voids (28) impressed therein, the body having a generally bow-tie shaped cross-section with convex surfaces (42) at its ends and impressions (36) formed in its sides by said voids to define reduced centre portions (38) in said cross-section, characterised in that the voids (28) are generally oval-shaped, that the major axes (30) of said voids extend parallel to the longitudinal axis (32) of said body, that the impressions (36) are symmetrically opposed and dish-shaped and in that said mounting portion (16) as a result of the impressions (36) therein, is deformable upon press fitting into a round circuit board aperture (40) so as to have the convex surfaces (42) at each end of the bow-tie shaped cross-section in intimate contact with the inside surface of said round aperture (40) whereby said reduced centre portion (38) plastically deforms and/or shears.

2. A terminal as claimed in claim 1, which has a mass of solder (46) adjacent said mounting portion (16), said mass of solder being positioned so as to flow, upon exposure to an external heat source, into interspaces (50) between an inserted mounting portion (16) and a corresponding circuit board aperture (40).

3. A terminal as claimed in claim 1 or 2, wherein one of said contacts is a spring arm (12) in line with the axis of the terminal (32).

4. A terminal as claimed in claim 1 or 2, wherein one of said contacts is a wire wrap tail (14), the other being a spring arm (12) having a free end (15) parallel to and offset from the axis (17) of the wire wrap tail.

5. A terminal as claimed in claim 4, wherein said spring arm contact (12) is bifurcated, said terminal (10) having a first shoulder (18), a neck portion (20), and a second shoulder (22) all positioned intermediate said spring arm contact (12) and said mounting portion (16).

6. An edgcard connector (60) which comprises:

(a) a plurality of elongate terminal (10) each having a contact (12, 14) at both ends and a deformable mounting portion (16) therebetween, said mounting portions being a press fit into apertures (40) in a supporting circuit board (52), one of said contacts of each terminal being a spring arm (12) having a free end (15), the second of said contacts being a wire wrap tail (14),

(b) an insulative housing (70) mated with said supporting circuit board (52), said housing



having means to removably receive, edgewise, a mating circuit board (80), and being adapted to fit over the spring arm contacts (12) of said plurality of terminals (10), the terminals being positioned in opposing rows in said apertures of the supporting circuit board, the housing having a wall (74) therein substantially parallel to the axes (17) of the wire wrap tails of inserted terminals, the wall being adapted to restrict the free ends of the spring arms to movement only along a plane parallel to the axes of said tails when a mating circuit board (80) is inserted into the connector (60), characterised in that the said mounting portion (16) of each terminal (10) has a generally cylindrical body with symmetrically opposed generally oval-shaped voids (28) impressed therein, the major axes (30) of said voids extending parallel to the longitudinal axis (32) of said body, the body having a generally bow-tie shaped cross-section with symmetrically opposed dish-shaped impressions (36) formed therein by said voids to define a reduced centre portion (28) in said cross-section, the reduced portion (38) of said cross-section of said mounting portion being adapted to be plastically deformed and/or sheared upon the press fitting of said mounting portion into a circuit board aperture (40).

7. An edgecard connector as claimed in claim 6, including mechanical fastener means for mating said insulative housing (70) with said supporting circuit board (52).

8. An edgecard connector as claimed in claim 6 or 7, wherein the spring arm contact (12) of each said terminal (10) is bifurcated, the terminal having a first shoulder (18), a neck (20), and a second shoulder (22) all positioned intermediate said spring arm contact (12) and said mounting portion (16).

9. An edgecard connector as claimed in any of claims 6—8 wherein the free end (15) of the spring arm (12) of each terminal (10) is parallel to and offset from the axis (17) of said wire wrap tail (14).

Patentansprüche

1. Ein länglicher elektrischer Anschluß (10) zum Preßsitz in einer Schaltplattenöffnung (40) mit einem Kontakt (12, 14) an jedem Ende und einem Halteteil (16) dazwischen, welcher Halteteil einen im wesentlichen zylindrischen Körper aufweist, in den Aushöhlungen (28) eingepreßt sind und der einen im wesentlichen wulstförmigen Querschnitt mit konvexen Flächen (42) an seinen Enden und Eintiefungen (36) hat, die an seinen Seiten durch die erwähnten Aushöhlungen geformt sind, um verengte Mittelteile (38) in dem erwähnten Querschnitt zu bilden, dadurch gekennzeichnet, daß die Aushöhlungen (28) eine im wesentlichen ovale Form haben, die Hauptachsen (30) der Aushöhlungen sich parallel zur Längsachse (32) des Körpers erstrecken, die Eintiefungen (36) symmetrisch entgegengesetzt und schalen-

förmig sind und daß der Halteteil (16) infolge der Eintiefungen (36) in diesem beim Einpressen in eine runde Schaltplattenöffnung (40) so verformbar ist, daß er konvexe Flächen (42) an jedem Ende des wulstförmigen Querschnitts in innigem Kontakt mit der Innenfläche der erwähnten runden Öffnung (40) aufweist, wodurch der verengte Teil (38) plastisch verformt wird und/oder absichert.

2. Ein Anschluß nach Anspruch 1, der eine Lötmittelmasse (46) benachbart dem Halteteil (16) besitzt, welche Lötmittelmasse so angeordnet ist, daß sie, wenn sie einer äußeren Wärmequelle ausgesetzt wird, in die Zwischenräume (50) zwischen einem eingesetzten Halteteil (16) und einer entsprechenden Schaltplattenöffnung (40) fließt.

3. Ein Anschluß nach Anspruch 1 oder 2, bei welchem einer der erwähnten Kontakte ein Federarm (12) in Ausfluchtung mit der Achse des Anschlusses (32) ist.

4. Ein Anschluß nach Anspruch 1 oder 2, bei welchem einer der erwähnten Kontakte ein Wire-Wrap-Anschluß (14) ist, der andere ein Federarm (12) mit einem freien Ende (15) parallel zu und versetzt von der Achse (17) des Wire-Wrap-Anschlusses ist.

5. Ein Anschluß nach Anspruch 4, bei welchem der Federarmkontakt (12) gegabelt ist, der erste Anschluß (10) eine erste Schulter (18), einen Halsteil (20) und eine zweite Schulter (22) aufweist, die alle zwischen dem Federarmkontakt (12) und dem Halteteil (16) angeordnet sind.

6. Ein Hochkant-Steckverbinder (60), mit (a) eine Vielzahl von länglichen Anschlüssen (10) je mit einem Kontakt (12, 14) an beiden Enden mit einem verformbaren Halteteil (16) dazwischen, welche Halteteile einen Preßsitz in Öffnungen (40) in einer tragenden Schaltplatte (52) haben, einer der erwähnten Kontakte jedes Anschlusses ein Federarm (12) mit einem freien Ende (15) ist, der zweite der erwähnten Kontakte ein Wire-Wrap-Anschluß (14) ist,

(b) ein Isoliergehäuse (70) passend zu der erwähnten tragenden Schaltplatte (52), welches Gehäuse Mittel besitzt zur kantenweisen Aufnahme einer passenden Schaltplatte (80) und über die Federarmkontakte (12) der erwähnten Vielzahl von Anschlüssen (10) geschoben werden kann, welche Anschlüsse in gegenüberliegenden Reihen in den erwähnten Öffnungen der tragenden Schaltplatte angeordnet sind, in welchem Gehäuse eine Wand (74) vorgesehen ist, die im wesentlichen parallel zu den Achsen (17) der Wire-Wrap-Anschlüsse der eingesetzten Anschlüsse ist, welche Wand dazu dient, die freien Enden der Federarme auf eine Bewegung nur längs einer Ebene zu beschränken, die parallel zu den Achsen der Wire-Wrap-Anschlüsse ist, wenn eine passende Schaltplatte (80) in den Steckverbinder (60) eingesetzt wird, dadurch gekennzeichnet, daß der Halteteil (16) jedes Anschlusses (10) einen

