

Description

The present invention relates generally to an electrical connector for accommodating a leaded chip carrier such as an integrated circuit carrier and more specifically relates to a cam actuated connector for supporting a leaded plastic chip carrier for connection to a printed circuit board.

The importance of integrated circuit semiconductors in the electronic industry is well known. These circuits have revolutionized the industry. Employed in miniaturized form and made into chips these circuits can be utilized in great numbers in very little space such as on printed circuit boards.

Integrated circuits formed into chips may be packaged in a rectangular plastic carrier having conductive leads extending from each marginal edge thereof. In order to connect this leaded chip carrier to a printed circuit board an electrical connector or socket is employed which provides mechanical and electrical connection between the conductive leads of the chip carrier and conductive traces on a printed circuit board.

A typical leaded chip carrier, such as that shown in US-A-4465898, includes an enclosure or body typically formed of an epoxy plastic and having a plurality of J-leads extending therefrom around its periphery. Connectors for accommodating plastic chip carriers typically include a rectangular (usually square) housing which supports around the perimetrical edge thereof a plurality of spring contacts. The body includes a central cavity into which the spring contacts extend. The spring contacts of the connector are biased into the cavity of the body such that upon insertion of the plastic chip carrier into the cavity there is substantial engagement between the J-leads of the plastic chip carrier and the spring contacts of the connector. In order to insure adequate electrical connection between the spring contacts and the J-leads a high degree of insertion force is necessary to insert the plastic chip carrier into the connector. While the necessary force may vary from connector to connector and carrier to carrier depending on construction, thickness and material composition, a high degree of manual force is usually necessary to insert the plastic chip carrier into the connector. This is especially true with plastic chip carriers having leads which may number as high as 68 or more as is now desired for increased circuit density. It is apparent that the force needed to urge the plastic chip carrier into engagement with the contacts of the connector may be so great as to render manual insertion by the user difficult. As difficult as insertion may be, extraction of the plastic chip carrier from the connector is even more difficult. Leaded plastic chip carriers, presently on the market, require the use of an extraction tool to remove the chip carrier from connector. Use of an extraction tool is necessitated in that the force to remove the chip carrier from the connector is so great that the user requires a mechanical advantage to make such

extraction. A typical extraction tool is a wheel puller having a screw-type shaft which supplies the mechanical advantage.

It is also apparent that the force exerted on each of the leads of the chip carrier by the individual contacts is also great. Thus, upon movement the contacts into engagement with the leads of the package significant deflection of the contacts take place. Without controlling the amount of deflection and direction of the deflection of the contacts, the contacts may be damaged upon repeated insertion and removal of the chip carrier in the housing.

A further connector for accommodating chip carriers is described in FR-A-2365899. The connector is similar in many respects to that of US-A-4465898, but the contacts have a particular configuration including a portion lying against a respective inner facing wall of the housing, and a free end bent inwardly. The chip carrier is inserted by J-leads forcing out the free ends of the contacts, the free ends returning over the J-leads when fully inserted.

Representing a different type of connector for a chip carrier which has zero force insertion of the chip carrier is US-A-4491378. In US-A-4491378, the contacts are free of contact with the J-leads when the chip carrier is initially located, the contacts being deflected into contact with the J-leads by action of a cam. The contacts are scrolled at their free end, the scrolled free ends contacting the J-leads, the cam acts on an intermediate portion of the contact, and deflection is carried out entirely inwardly towards the chip carrier, there being no deflection limiting features of intermediate parts of the contacts.

According to the invention there is provided an electrical connector for accommodating a chip carrier having plural electrical elements thereon, said connector comprising:

a housing having a central cavity for insertable receipt of said chip carrier in an insertion direction;

a plurality of elongate electrical contacts supported in said housing having a free end extending into said cavity, each of said contacts having at the free end thereof a cam engagement portion, an element engaging portion spaced therefrom and a deflection extent spaced from said element engaging portion, said deflection extent having a preformed configuration to deflect away from said central cavity;

cam means actuatable for engaging said cam engagement portions and for urging said element engaging portions against said electrical elements of said chip carrier and for providing an engagement force thereagainst in said insertion direction whereby said chip carrier is retentively held in said housing; and

a stop wall formed on said housing for limiting the amount of deflection of said deflection extent.

By way of example, one embodiment of a connector according to the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 shows in partially broken away perspective view, the chip carrier connector of the present invention with a leaded chip carrier shown thereabove;

Figure 2 is a sectional fragmented showing of a portion of the connector of Figure 1 employing therein one of a plurality of electrical contacts;

Figure 3 is a sectional showing similar to that of Figure 2 with a leaded chip carrier inserted therein;

Figure 4 is a sectional showing similar to that of Figures 2 and 3 with the cover shown in the actuated position; and

Figure 5 is a front plan view of an extraction tool useful in removing the chip carrier of Figure 1.

Referring to Figure 1, chip carrier 10 is shown having basically a square shape. Carrier 10 includes an enclosure 12 and a plurality of leads 14 extending along the perimetrical edge thereof. Leads 14 are constructed of an electrically conductive metallic material, for example a copper alloy, and are formed into an industry designated "J" pattern. The leads 14 are commonly referred to as J-leads. Enclosure 12 is typically formed of a suitable plastic, for example epoxy as is readily known in the art. Enclosure 12 encloses a electronic semiconductor chip (not shown) which is suitably electrically connected to a lead frame which connects to J-leads 14. One flattened corner 12a is provided as a polarization feature to prevent incorrect insertion of carrier 12.

Also shown in figure 1 is the electrical connector 20 of the present invention. Connector 20 includes a substantially square body 22, which is constructed typically of an insulative plastic material, having four side walls 24. Body 22 defines between side walls 24 a central cavity 26 which accommodates and houses chip carrier 10 therein. As illustrated in Figure 1, cavity 26 extends through the bottom of connector housing 20 to provide an air-cooling opening for chip carrier 12. However, it is not essential that the cavity extend through the bottom of connector 20.

Connector 20 further includes a four-walled, open rectangular (usually square) cover 28 which is movably supported over walls 24 of body 22. As will be described in greater detail hereinbelow, cover 28 is movable in a vertical position, as shown in Figure 1, to secure a chip carrier 10 in connector 20. In order to accommodate chip carrier 10, cover 28 has a substantially open central area 30 which is aligned and in communication with central cavity 26. Body 22 of connector 20, further includes a pair of hingedly attached levers 32 and 34 on opposite sides thereof for supporting cover 28 in one of two different vertical positions as will be described in greater detail hereinbelow.

Referring additionally to Figure 2, body side walls 24 each include a plurality of slotted channels 28a each opening into central cavity 26. Each slotted channel 28a supports and separates an electrically conductive contact 40. In the present illustrative embodiment, as shown in figure 1, each side wall 24 is segmented by 16

channels thus providing a 68 contact connector. However, it is understood that the invention may also be employed with a connector having higher or lower numbers of contacts.

Each contact 40 is an elongated member having a free extent 41 which extends adjacent central cavity 26 and a tail extent 42 which extends below and externally of body 22 of connector 20. Tail extent 42 provides for external electrical connection with conductive traces on a printed circuit board (not shown) or similar device. A portion of contact 40 is retainably supported in body 22 by force fitting or other conventional securement means. In the present illustrative embodiment detent means 44 is provided in slotted channel 28a. Free extent 41 of contact 40 is formed to have a tortuous profile with several alternating contours therealong. The first major contour is cam engagement portion 43 at the distal free end of contact 40. Cam engaging portion 43 is bowed with a concavity facing central cavity 26. This construction presents a curved bearing surface 43a adjacent an inside wall of cover 28 for engagement therewith as will be described in further detail hereinafter. A second major contour is lead engaging portion 45 spaced from cam engagement portion 43, which is bowed in the opposite direction from that of cam engagement portion 43. This construction presents a curved bearing surface 45a adjacent cavity 46 for engagement with J-lead 14 upon insertion of package 12 into cavity 26 as will be described in detail hereinafter. A third major contour is deflection portion 47 which is spaced from lead engaging portion 45 and is bowed in the direction opposite therefrom. This construction provides for compressive movement of contact 40 upon actuating movement of cover 28. A minor bowed section 49 is provided in the lower extent of contact 40 in channel 28a again to provide for compressive deflection of contact 40.

Having described basic elements of connector 20 of the present invention its operation may now be described with reference to Figures 2 through 4. Referring initially to Figure 2, connector 20 is shown in a pre-connection position with cover 28 raised vertically from housing 22. Contact 40 is in an unbiased or unstressed position with the free extent 41 extending upwardly from body 22. Latch 32 is shown seated in a first recess 32a of cover 28 which permits the cover to remain in its vertically raised position. A pair of cooperating detents 31 and 33 on cover 28 and housing 22 respectively, permit such vertical movement and support the cover 28 in its "up" position.

Referring now to Figure 3, chip carrier 12 is inserted downwardly, as is substantially shown by arrow A, through central opening 30 (Fig. 1) of cover 28 and into central cavity 26 of housing 22. As the chip carrier is inserted, J-lead 14 extending therefrom engages the curved bearing surface 45a of lead engaging portion 45, thereby deflecting contact 40 about schematically represented pivot point 50, away from cavity 26. As chip carrier 12 is inserted into cavity 26, the outside

surface 14a will slide against contact surface 45a to provide a wiping action upon insertion, thereby assuring electrical contact therebetween. As entry of the chip carrier causes movement of contacts 40, against the leads 14, the carrier will be inserted against some low resistive force, thus making the connection a low insertion force (LIF) connection. The bottom surface 12a of chip carrier 12 will contact support surfaces 22a of body 22 such that the chip carrier will be seated in body 22. In the position shown in Figure 3, chip carrier 12 will be accommodated in connector 20 with a low retention force which enables easy manual insertion and removal of the chip carrier:

Referring now to Figure 4, cover 28 may be brought down vertically over chip carrier 12 to secure the chip carrier in cavity 26. As cover 28 is brought down, curved bearing surface 43a of cam engagement portion 43 engages an inside tapered wall 52 of cover 28. As the cover is progressively brought down, contact 40 will deflect at several locations. Initially, cam engaging portion 43 will deflect inwardly toward chip carrier 12 urging lead engaging portion 45 into tighter engagement with J-lead 14. Further, deflection portion 47 will deflect outwardly away from chip carrier 12 due to its pre-formed bowed construction until it engages inside vertical surface 24a of wall 24 which serves as a stop member preventing over stressing of contact 40. The bow placed in deflection portion 47 will allow controlled directional deflection of contact 40. Bowed portion 49 will engage side wall 28b of channel 28a which also serves as a stop member preventing over stressing of the contact 40. The cover is brought down until shoulder 54 of cover 28 rests on top surface 56 of wall 24. In this position contact 40, at lead engaging portion 45, exerts a high degree force on lead 14 of chip carrier 12.

It is noted that substantially tangential contact is made between the curved bearing of surface 45a and curved portion 14b of lead 14. This tangential contact is represented by line L. The force which urges contact 40 into engagement with lead 14 is normal to tangent line L, as represented by vector N. It is further noted that normal force vector N is a resultant of a vertical vector V and a horizontal vector H. Thus the normal force is directed in a substantially downward direction and serves to hold chip carrier 12 securely in cavity 26 with a high degree of retention force. By contacting J-lead 14 on its curved upper portion 14b there is resultant tangential contact made along line L which provides a normal force which is substantially downwardly directed below the horizontal plane. If contact portion 45a were to engage lead 14 along the lower straight section 14a thereof, there would be a tendency for the spring bias of the contact to urge the chip carrier upward out of its retained position in cavity 26. This may be a problem encountered upon shock, vibration or flexing of the printed circuit board on which connector 20 is mounted. Thus, by providing a

normal vector which is substantially downward in direction, the chip carrier is more securely retained in cavity 26.

After the cover is moved down into its seated position securely retaining chip carrier 12 in cavity 26 pivotal latch 32 may be moved from its up position, shown in Figure 3, to its locked position, shown in Figure 4. This will secure the cover 28 down over body 22. The spring engagement of contact 40 with leads 14 will naturally exert a slight upward pressure in direction opposite normal vector N. This will urge cover 28 against pivotal latch 32 securely holding the latch 32 in place.

To remove the chip carrier 12 the steps just described are performed in the opposite manner. Latch 32 is moved down from its seated position, shown in Figure 4, to the position, shown in Figure 3. The cover may then be moved upward to release the high contact force between contacts 40 and leads 14. The chip carrier 12 may then be removed from cavity 26 with only a light force of contacts 40 against leads 14 being exerted, as shown in Figure 3.

While no special insertion or extraction tools are needed to use the connector of the present invention, a small grabbing tool may be necessary to extract carrier 12 in that it presents no grabbing surface once accommodated in cavity 26. Referring to Figure 5, a simple extraction tool is provided. Tool 60 is a plunger-type tool having a central main shaft 62 connected at one end thereof to a suction-cup device 64. Tool 60 may be placed on top of chip carrier 12, whereupon the suction cup 64 will engage the upper surface thereof in a conventional manner to assist in insertion and removal of the device.

Claims

1. An electrical connector (20) for accommodating a chip carrier (10) having plural electrical elements (14) thereon, said connector comprising:

a housing (22) having a central cavity (26) for insertable receipt of said chip carrier in an insertion direction;

a plurality of elongate electrical contacts (40) supported in said housing having a free end (41) extending into said cavity, each of said contacts having at the free end thereof a cam engagement portion (43), an element engaging portion (45) spaced therefrom and a deflection extent (47) spaced from said element engaging portion, said deflection extent (47) having a preformed configuration to deflect away from said central cavity;

cam means (28) actuatable for engaging said cam engagement portions and for urging said element engaging portions against said electrical elements of said chip carrier and for providing an engagement force thereagainst in said insertion direction whereby said chip carrier is retentively held in said housing; and

a stop wall (24a) formed on said housing for



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Claims

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a housing (22) having a central cavity (26) for insertable receipt of said chip carrier in an insertion direction;

a plurality of elongate electrical contacts (40) supported in said housing having a free end (41) extending into said cavity, each of said contacts having at the free end thereof a cam engagement portion (43), an element engaging portion (45) spaced therefrom and a deflection extent (47) spaced from said element engaging portion, said deflection extent (47) having a preformed configuration to deflect away from said central cavity;

cam means (28) actuatable for engaging said cam engagement portions and for urging said element engaging portions against said electrical elements of said chip carrier and for providing an engagement force thereagainst in said insertion direction whereby said chip carrier is retentively held in said housing; and

a stop wall (24a) formed on said housing for



limiting the amount of deflection of said deflection extent.

2. An electrical connector in accordance with claim 1 wherein said cam means includes a cover (28) having a cam surface (52) for engagement with cam engagement portion (43) of said contact, said cover (28) being movable from a first position non-engaging said contacts to a second position engaging said contacts.

3. A connector in accordance with claim 2 wherein said housing (22) includes a latch (32) for securing said cover in said second position.

4. A connector in accordance with claim 3 wherein said cover includes a central opening for permitting passage of said chip carrier into said housing cavity (26).

5. A connector in accordance with claim 1 wherein said cam engagement portion has a deflectable bowed extent (47), bowed away from said central cavity.

6. A connector in accordance with claim 1 wherein said element engagement portion has a deflectable bowed extent (45), bowed towards said central cavity.

7. A connector in accordance with claim 6 wherein said deflection extent is bowed in a direction away from said central cavity.

Patentansprüche

1. Ein elektrischer Verbinder (20) zur Aufnahme eines Chipträgers (10) mit mehreren elektrischen Elementen (14) auf diesem, wobei der Verbinder die folgenden Merkmale umfaßt:

ein Gehäuse (22) mit einer zentralen Ausnehmung (26) zur einschiebbaren Aufnahme des Chipträgers in einer Einschieberichtung;

eine Vielzahl von in dem Gehäuse abgestützten langgestreckten elektrischen Kontakten (40) mit einem in die Ausnehmung hinein verlaufenden freien Ende (41), wobei jeder der Kontakte am freien Ende einen Nocken-Anlageabschnitt (43), einen von diesem in einem Abstand liegenden und mit einem Element in Anlage liegenden Abschnitt (45) und eine von diesem in einem Abstand liegende Biegeerstreckung (47) aufweist, wobei diese Biegeerstreckung (47) zum Wegbiegen von der zentralen Ausnehmung eine vorgeformte Gestalt aufweist;

Nockenmittel (28), die zur Anlage an den Nocken-Anlageabschnitten und zum Drücken der mit dem Element in Anlage liegenden Abschnitte gegen die elektrischen Elemente des Chipträgers und zum Ausüben einer Anlagekraft am Chipträger in der Einschieberichtung betätigbar sind, wodurch der Chipträger in dem Gehäuse zurückhaltend gehalten wird; und

eine auf dem Gehäuse ausgebildete Anschlagwand (24a) zum Begrenzen des Betrages des Ausbiegens der Biegeerstreckung.

2. Ein elektrischer Verbinder nach Anspruch 1, wobei das Nockenmittel einen Deckel (28) mit einer Nockenfläche (52) zur Anlage an dem Nocken-Anlageabschnitt (43) des Kontaktes aufweist, wobei der Deckel (28) aus einer mit den Kontakten

außer Anlage stehenden ersten Stellung in eine mit den Kontakten in Anlage stehende zweite Stellung verschiebbar ist.

3. Ein Verbinder nach Anspruch 2, wobei das Gehäuse (22) einen Riegel (32) zum Sichern des Deckels in der zweiten Stellung enthält.

4. Ein Verbinder nach Anspruch 3, wobei der Deckel eine zentrische Öffnung zum Ermöglichen eines Durchganges des Chipträgers in die Gehäuseausnehmung (26) enthält.

5. Ein Verbinder nach Anspruch 1, wobei der Nocken-Anlageabschnitt eine durchbiegungsfähige weggebogene Erstreckung (47), die von der zentralen Ausnehmung weggebogen ist, aufweist.

6. Ein Verbinder nach Anspruch 1, wobei der Element-Anlageabschnitt eine durchbiegungsfähige weggebogene Erstreckung (45), die in Richtung auf die zentrale Ausnehmung gebogen ist, aufweist.

7. Ein Verbinder nach Anspruch 6, wobei die Biegeerstreckung in einer Richtung weg von der zentralen Ausnehmung gebogen ist.

Revendications

1. Un connecteur électrique (20) prévu pour recevoir un support de circuits intégrés (10) qui supporte plusieurs éléments électriques (14), ce connecteur comprenant:

un boîtier (22) ayant une cavité centrale (26) pour recevoir le support de circuits intégrés qui est inséré dans le boîtier dans une direction d'insertion;

un ensemble de contacts électriques allongés (40) supportés dans le boîtier et ayant une extrémité libre (41) qui s'étend à l'intérieur de la cavité, chacun de ces contacts ayant à son extrémité libre une partie de contact avec une came (43), une partie de contact avec un élément (45), espacée par rapport à la partie de contact avec une came, et un segment dévié (47), espacé par rapport à la partie venant en contact avec un élément, ce segment dévié (47) ayant une configuration qui est pré-formée de façon à être déviée en direction opposée à la cavité centrale;

une structure de came (28) que l'on peut actionner pour l'amener en contact avec les parties de contact avec une came, et pour appliquer les parties de contact avec un élément contre les éléments électriques du support de circuits intégrés, et pour établir une force de contact contre ces derniers, dans la direction d'insertion, grâce à quoi le support de circuits intégrés est retenu à l'intérieur du boîtier; et

une paroi d'arrêt (24a) qui est formée dans le boîtier pour limiter la valeur de la déviation du segment dévié.

2. Un connecteur électrique selon la revendication 1, dans lequel la structure de came comprend un couvercle (28) ayant une surface de came (52) qui est conçue pour venir en contact avec la partie de contact avec une came (43) des contacts précités, ce couvercle (28) pouvant être déplacé depuis une première position dans laquelle il est



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séparé des contacts, jusqu'à une seconde position dans laquelle il vient en contact avec les contacts.

3. Un connecteur selon la revendication 2, dans lequel le boîtier (22) comprend un dispositif de verrouillage (32) pour fixer le couvercle dans la seconde position.

4. Un connecteur selon la revendication 3, dans lequel le couvercle comprend une ouverture centrale pour permettre le passage du support de circuits intégrés qui est introduit dans la cavité (26) du boîtier.

5. Un connecteur selon la revendication 1, dans lequel la partie venant en contact avec une came comporte un segment courbé et déformable (47) qui est courbé en direction opposée à la cavité centrale.

6. Un connecteur selon la revendication 1, dans lequel la partie venant en contact avec un élément comporte un segment courbé et déformable (45) qui est courbé en direction de la cavité centrale.

7. Un connecteur selon la revendication 6, dans lequel le segment déformable est courbé dans une direction opposée à la cavité centrale.

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