

TITLE OF INVENTION

Zero Insertion Force Type Socket

DETAILED DESCRIPTION**Field of invention**

This invention is directed to a ZIF (Zero Insertion Force) type socket, more particularly, a ZIF type IC socket for interconnecting an IC package like a BGA (Ball Grid Array) to a board.

Prior art

In the field of a personal computer, it is often demanded that a CPU (central processing unit) can be easily replaced by a faster CPU since the CPU is greatly being improved in its performance. In such a case, a ZIF type socket is often used for receiving a package of the CPU therein and interconnecting the CPU to a board. In general, this kind of ZIF type socket has a lever member for actuating a slide member that make built-in contacts open and closed, as shown in JP U 59-180435.

However, since recent personal computers become remarkably miniaturized as represented by a note-book type personal computer, the personal computers no longer can afford to have a space or volume for allowing the lever member to rotate. Accordingly, an IC socket without the lever member is proposed, wherein a slide member is driven by a tool like a screw driver only when an IC package such as the CPU is replaced. For example, JP B 2-54632 discloses a ZIF type IC socket as shown in Fig. 13, wherein spring contact portions 142 of contacts 140 thereof are driven to make contact with leads of an IC package (not shown) by a tool 170 having a rectangular shape in cross section that is separated from the IC socket 110. In order to make the spring contact portions 142 of the contacts 140 contact with the leads of the IC package, the tip of the tool 170 is first inserted into a substantially triangular tool insertion hole 152 formed in a slide member 150 and a substantially triangular tool insertion hole 134 (see Fig. 14)

formed in a socket body 130. The tool 170 is then rotated clockwise so that the slide member 150 is moved in a direction of Arrow A (see Fig. 14). By movement of the slide member 150, the spring contact portions 142 of the contacts 140 accommodated in recesses 154 in the slide member 150 are urged outwardly to make contact with the leads of the IC package.

Problems to be solved by the invention

However, the socket body 130 and the slide member 50 are generally made of plastic material so that one side edge portion 172 of the tool 170 may bite into one side 152a of the substantially triangular tool insertion hole 152 to cause depression or breakdown of the one side 152a when the slide member 150 is moved by rotation of the tool 170. Accordingly, there is a problem that the IC socket 110 cannot endure a number of insertion and extraction of the IC package, in other words, a number of movements of the slide member 150.

Moreover, since an action point in the tool insertion hole 152 of the slide member 150, which abuts against the tool 170, is always a point that abuts against a corner (the side edge portion 172) of the tool 170, a distance from a fulcrum of the tool 170 becomes relatively large. Accordingly, there is another problem that force for rotating the tool 170 cannot be reduced.

Therefore, an object of this invention is to provide a small ZIF type socket that has high endurance for a number of movements of the slide member.

A further object of this invention is to provide a ZIF type socket wherein force for driving a tool is relatively low.

Means to solve the problems

A zero insertion force type socket according to this invention comprising a base housing accommodating a number of contacts therein and a slide member slidable on said base housing, said slide

member being relatively moved by inserting a plate-like tool into tool insertion holes in said base housing and said slide member and rotating said tool, said socket being characterized in that said tool insertion holes are formed with arcuate projections that function as action points with which said tool abuts.

It is preferable that a member having said arcuate projection is a metal member separately formed with said base housing and said slide member and attached to each of said base housing and said slide member.

It is also preferable that a distance between said arcuate projection of said base housing and said arcuate projection of said slide member is shorter than length of a longer side of said tool.

Embodiments of the invention

A preferable embodiment of a ZIF type IC socket according to this invention will now be described with reference to accompanying drawings, in which;

Fig. 1 shows an embodiment of an IC socket according to this invention, wherein (A) is a plan view, (B) is a front view and (C) is a right side view.

Fig. 2 is an enlarged cross section taken along line 2-2 in Fig. 1(A).

Fig. 3 is an enlarged cross section taken along line 3-3 in Fig. 1(A).

Fig. 4 shows a base housing assembly of the IC socket of Fig. 1, wherein (A) is a plan view, (B) is a front view and (C) is a right side view.

Fig. 5 is an enlarged cross section taken along line 5-5 in Fig. 4(A).

Fig. 6 is an enlarged plan view of a portion indicated by 6 in Fig. 4(A).

Fig. 7 shows a cover housing of the IC socket of Fig. 1, wherein (A) is a plan view, (B) is a front view and (C) is a right side view.

Fig. 8 is an enlarged cross section taken along line 8-8 in Fig. 7.

Fig. 9 shows a base support plate, wherein (A) is a plan view,

(B) is a cross section taken along line 9B-9B of Fig. 9(A) and (C) is a rear view.

Fig. 10 is a plan view of a cover support plate.

Fig. 11 is an enlarged view showing an operating portion prior to moving the cover housing assembly.

Fig. 12 is an enlarged view showing an operating portion after moving the cover housing assembly.

A ZIF type IC socket (hereinafter "IC socket") 1 as shown in Fig. 1 is mounted on a circuit board (not shown) and is for interconnecting pins of a pin grid array type IC package to pads (not shown) on the circuit board. The IC socket 1 includes a base housing assembly 10 accommodating therein a number of contacts 30 (see Figs. 2, 5 and 6) arranged in matrix, and a cover housing assembly (slide member) 40 arranged to be horizontally movable on the housing assembly 10 to drive the contacts 30. The housing assembly 10 shown in Fig. 4 includes a base housing 11, the number of contacts 30, a number of solder balls 19 arranged below the housing 11, and a base support plate 60 placed on an operation portion 20 of the housing 11. The base housing 11 is formed by molding suitable plastic having heat resistance and dielectric characteristics such as liquid crystal polymer. The base housing 11 includes a contact accommodating portion 12 having rectangular shape in plan view, and an operating portion 20 formed integrally with the accommodating portion 12 on the left side thereof shown in Fig. 4(A). The base housing 11 has 495 (24 lines by 21 columns matrix but 9 cavities lacks at the corners thereof) contact accommodating cavities 13 where a part thereof are omitted in Fig. 4. As shown in Figs. 2 and 5, each contact accommodating cavity 13 is basically formed as a recess having an opening in a top face 14 thereof with an insertion hole for receiving a tine portion 31 of the contact 30 therein communicating with a bottom face 15 via a solder ball receiving recess 17. The solder ball receiving recess 17 is formed frusto-conically corresponding to each contact

accommodating cavity 13. Each solder ball receiving recess 17 has a tapered face 18 substantially parallel to a tangent of a solder ball 19 received therein, and has a depth larger than radius of the solder ball 19. The tapered face 18 is formed such that the tine portion 31 is positioned as the center thereof. When the solder ball 19 is formed in the recess 17, a projecting height of the solder ball 19 from the housing bottom face 15 is controlled and the center of the solder ball 19 coincides with the center of the recess 17 accordingly.

As shown in Figs. 2, 5 and 6, Each contact 30 accommodated in each contact accommodating cavity 13 is formed by stamping and forming sheet metal having spring resiliency and conductivity such as beryllium-copper. The contact 30 has a pair of contact arms 33 extending from both sides of a base portion 32 toward the operating portion 20 of the base housing 11 (or in the left direction in Fig. 4(A)). The pair of arms 33 converge as the arms go toward the tips thereof. On both sides of the tine portion 31 extending downwardly from the base portion 32, stop projections 34 are formed at the upper position and press fit projections 35 at the lower position. The stop projections 34 are for determining press fit lowermost position of the contact 30. The press fit projections 35 are for securing the tine portion 31 in the insertion hole 16. A lower end 37 of the tine portion 31 is formed as a tine to project into the solder ball accommodating recess 17 such that it securely make contact with the solder ball 19.

As shown if Fig. 4, the operating portion 20 of the base housing 11 has a projection 21 projecting in the left (in Fig. 4(A)) at substantially the center thereof. Substantially the whole of the operating portion 20 including the projection 21 is covered by a base support plate 60 (see Fig. 9). A top face 61 of the base support plate 60 is designed to substantially flush with the top face 14 of the contact accommodating portion 12. The base support plate 60 is

placed in a recess defined by a left end wall 22 of the operating portion 20 and a left edge of the contact accommodating portion 12. Engagement of projections 23,23 formed on the operating portion 20 with holes 62,62 in the base support plate 60 prevents the plate 60 from horizontally moving relative to the base housing 11. The operating portion 20 is provided with engage projections 24,24 at the ends thereof. Engagement of the projections 24,24 with engage holes 63,63 at the both ends of the support plate 60 prevent the base support plate 60 from dropping out of the vase housing 11. At substantially the center of the operating portion 20, a tool insertion hole (not shown) is formed that is slightly larger than a tool insertion hole (see Fig. 9) of the base support plate 60.

With reference to Fig. 9, the base support plate 60 is a flat member except bent portions at both ends thereof, which is formed by stamping and forming sheet metal having stiffness and wear resistance such as stainless steel. At the center thereof including a projection 64 projecting leftwardly, the tool insertion hole 65 is formed to penetrate therethrough that is positioned biased upwardly in Fig. 9(A). The tool insertion hole 65 includes a wider portion 66 at the lower of Fig. 9(A), a narrower portion 67 at the upper and a transition portion 68 connecting them. At the wider portion 66, a right side 69 thereof is substantially parallel to the axial direction of the plate 60 while a left side 70 thereof is formed as a tapered face diverging from the right side as it goes downwardly. It is intended that a side face of a tool 99 becomes parallel to the left side 70 such as not to interfere with the left side 70 upon completion of movement of the cover housing assembly 40 as shown in Fig. 12. The narrower portion 67 has opposed sides 71,72 that are substantially parallel to each other. At the transition portion 68, a left side 73 thereof is substantially parallel to the axial direction of the plate 60 while a right side 74 thereof is formed as a tapered face diverging from the left side as it goes downwardly. The right side 74 connects the wider portion 66 and the narrower portion 67

accordingly. At a border between the narrower portion 67 and the transition portion 68, arcuate projections 75,76 are oppositely formed. The border between the tapered right side 74 of the transition portion 68 and the right side 69 of the wider portion 66 is designed such as to coincide with the center of plate 60 in the elongate direction.

The cover housing assembly 40 (see Fig. 1) includes a cover housing 41 shown in Fig. 7, and a cover support plate 80 (see Fig. 10) placed on the operating portion 47 of the cover housing 41. The cover housing 41 is formed by molding suitable plastic material having insulative characteristic, and includes an IC package place portion 42 formed in rectangular shape in plan view and an operating portion 47 integrally formed on a left side of the place portion 42 in Fig. 7(A). The cover housing 41 has pin insertion holes 43 in matrix which number is the same as that of the contact cavities. As shown in Fig. 8, each pin insertion hole 43 includes a larger radius portion 44 which peripheral is tapered, and a smaller radius portion 45 communicating with the larger radius portion 44. The larger radius portion 44 can securely receive a large radius flange (not shown) at a root of the pin of the IC package.

On upper and lower sides of the IC package place portion 42 in Fig. 7(A), engage holes 46,46 are formed to receive projections 26 (see Fig. 4(A)) on side edges of the base housing 10 to retain the cover housing assembly 40 relative to the base housing assembly 10. Since each engage hole 46 is formed longer than the projection 26 of the base housing 11 (see Fig. 1), the cover housing assembly 40 can move in right and left directions in Fig. 1(A). The operating portion 47 has a projection 48 projecting leftwardly in Fig. 1(A) at the substantially center thereof like the base housing 11. Substantially the whole of the operating portion 47 including the projection 48 is covered by the cover support plate 80 (see Fig. 10). The main or top face of the operating portion 47 is substantially

flush with the top face 49 of the IC package place portion 42 such that a top face 81 of the cover support plate 80 projects upper than the top face 49 of the IC package place portion 42. The operating portion 47 has projections 50,51,51 at the left edge thereof that receive a force exerted on the cover support plate 80 by a tool (not shown). The operating portion 47 also has reverse L-shaped projections 53,53 positioned oppositely relative to an tool insertion hole 55. The projections 53,53 engage holes 82,82 in the cover support plate 80 to prevent the cover support plate 80 from dropping out of the cover housing 41 and from moving laterally in Fig. 7(A). It is obvious from Fig. 7(C) that the projections 53,53 are formed in the reverse L-shaped. Accordingly, the engagement of the an arm 83 at the end of the cover support plate 80 with a hole 54 of the operating portion 47 of the cover housing 41 prevents the plate 80 from moving downwardly in Fig. 7(A) when the plate 80 is placed on the operating portion 47 and the plate 80 is moved upwardly in Fig. 7(A) and the arm 83 is pushed into the hole 54. At substantially the center of the operating portion 47, a tool insertion hole 55 is formed that is larger than the tool insertion hole 85 in the cover support plate 80.

With reference to Fig. 10, the cover support plate 80 is a flat member which is formed by stamping and forming sheet metal having stiffness and wear resistance such as stainless steel like the base support plate 60. At the center of the cover support plate 80 including a projection 84 projecting leftwardly therefrom, the hole 85 is formed to penetrating therethrough same as the case of the base support plate 60. The tool insertion hole 85 has an entire shape similar to the tool insertion hole 60 in the case support plate 60, which comprises a wider portion 86, a narrower portion 87 and a transition portion 88 connecting them. However, the hole 85 is different from the hole 65 in the plate 60 in that the hole 85 is formed in 180 degree rotation and in that the center of the hole 85 substantially coincides with the center of the projection 84 along the

upper and lower directions in Fig. 10. Arcuate projections 95,96 of the tool insertion hole 95 are not located at the center of cover support plate 80 in the elongate direction thereof that become action points when the cover housing assembly 40 is driven by using the tool 99 (see Fig. 11). However, the projections 95,96 are intended to be located on the center line O in the longitudinal direction of the assembly 40 after the plate 80 is assembled on the cover housing 41 as shown in Fig. 11.

With reference to Figs. 1, 11 and 12, operation of the ZIF type IC socket according to this invention will be described. In Fig. 1 showing the state prior to moving of the cover housing assembly, an IC package such as a CPU (not shown) is placed on the IC package place portion 42. The tool 99 having a rectangular shape in cross section such as a minus screw driver is then inserted into the tool insertion holes 86,65 communicating with each other, and is rotated clockwise as shown in Fig. 11. Since the minus screw driver is generally formed as tapering at the tip thereof, the left side 99a (shown as solid line) of the tool 99 engages with the left arcuate projection 95 of the plate 80 and the right side 99b (shown as broken line) of the tool 99 engages with the right arcuate projection 75 of the plate 60 such that the tool 99 exerts a force on the projections 95,75. Thereby, the cover housing assembly 40 is moved leftwardly relative to the base housing assembly 10.

Since the projections 95,75 are parts of the metal support plates 80,60 having stiffness and contact surfaces thereof are arcuate, resistance thereof against the force exerted by the tool 99 is large such that the projections can transmit the force exerted by the tool 99 to the housing assembly 10,40 without depression or breakdown of the support plate 80,60. Moreover, since the projection 75,95 result in that the sides 71,91 of the narrower portion 67,87 are relatively recessed, the corners of the tool 99 do not interfere with the sides 71,91 in the moved state as shown in Fig. 12 and the

depression or breakdown does not occur in the sides 71,91. Furthermore, since the arcuate projections 95,96 are located on the center line O in the upper and lower directions in Fig. 1(A), the whole cover housing assembly 40 can be moved evenly leftwardly upon relative movement of the assembly 40. Moreover, since the projections 75,76,95,96 are arranged in position relatively near the pivot axis of the tool 99 and distance between the projections 75,95 positioned diagonally and distance between the projections 76,96 positioned diagonally are designed to be shorter than the longer side of the tool 99, a force for driving the tool 99 is low and longer sides of a slightly small tool can securely engage with the projections 75,76,95,96. On the way from the state of the cover housing assembly 40 shown in Fig. 11 (or Fig. 1) to the state of the assembly shown in Fig. 12, the pins of the IC package (not shown), which are inserted into the pin insertion holes 43 in the cover housing 41 to be inserted into spaces between the base portions 32 and the contact arms 33 of the contacts 30, are forced to enter between the pairs of contact arms 33 to achieve connection of the pins to the contacts 30 in the state shown in Fig. 12.

In the case where the IC package disengage with the contacts 30, the tool 99 is inserted into the tool insertion holes 85,65 communicating with each other as shown in Fig. 12 and is rotated counterclockwise. In this case, the right side 99c (shown as solid line) of the tool 99 engages with the right arcuate projection 96 of the cover support plate 80 and the left side 99d (shown as broken line) of the tool 99 engages with the left arcuate projection 76 of the base support plate 60 such that the tool 99 exerts a force on the projections 96,76. Thereby, the cover housing assembly 40 is moved leftwardly relative to the base housing assembly 10.

Although the preferable embodiment according to this invention has been described, this invention is not limited to the aforementioned embodiment and can be modified within the spirit of

this invention, if necessary. For example, one sides 69,89 of the wider portions 66,86 of the tool insertion holes 65,85 can be formed as extensions of the tapered sides 74,94 of the transition portions 68,88. The tool insertion holes 65,85 can have the other shapes.

Advantages of the invention

The ZIF type socket of claim 1 is characterized in that the tool insertion holes of the base housing and the slide member are formed with arcuate projections that function as action points with which the tool abuts. Therefore, it is an advantage that the force exerted by the tool can be transmitted to the base housing and the slide member without depression or breakdown of the tool insertion holes such that the ZIF type socket having high endurance can be obtained.

The ZIF type socket of claim 2 is characterized in that a member having the arcuate projection is a metal member separately formed with the base housing and the slide member and attached to each of the base housing and the slide member. Therefore, it is an advantage that the ZIF type socket having further high endurance can be obtained.

The ZIF type socket of claim 3 is characterized in that a distance between said arcuate projection of said base housing and said arcuate projection of said slide member is shorter than length of a longer side of said tool. Therefore, it is an advantage that a force for driving the tool is low and longer sides of a slightly small tool can securely engage with the projections.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 shows an embodiment of an IC socket according to this invention, wherein (A) is a plan view, (B) is a front view and (C) is a right side view.

Fig. 2 is an enlarged cross section taken along line 2-2 in Fig.

1(A).

Fig. 3 is an enlarged cross section taken along line 3-3 in Fig.

1(A).

Fig. 4 shows a base housing assembly of the IC socket of Fig. 1, wherein (A) is a plan view, (B) is a front view and (C) is a right side view.

Fig. 5 is an enlarged cross section taken along line 5-5 in Fig.

4(A).

Fig. 6 is an enlarged plan view of a portion indicated by 6 in Fig. 4(A).

Fig. 7 shows a cover housing of the IC socket of Fig. 1, wherein (A) is a plan view, (B) is a front view and (C) is a right side view.

Fig. 8 is an enlarged cross section taken along line 8-8 in Fig.

7.

Fig. 9 shows a base support plate, wherein (A) is a plan view, (B) is a cross section taken along line 9B-9B of Fig. 9(A) and (C) is a rear view.

Fig. 10 is a plan view of a cover support plate.

Fig. 11 is an enlarged view showing an operating portion prior to moving the cover housing assembly.

Fig. 12 is an enlarged view showing an operating portion after moving the cover housing assembly.

Description of Reference Numerals

- 1.....ZIF type socket
- 10.....base housing assembly (base housing)
- 40.....cover housing assembly (slide member)
- 60.....base support plate (metal member)
- 65,85.....tool insertion hole
- 75,76,95,96...arcuate projection
- 80.....cover support plate (metal member)



CLAIMS FOR PATENT

1. A zero insertion force type socket comprising a base housing accommodating a number of contacts therein and a slide member slidable on said base housing, said slide member being relatively moved by inserting a plate-like tool into tool insertion holes in said base housing and said slide member and rotating said tool, said socket being characterized in that:

said tool insertion holes are formed with arcuate projections that function as action points with which said tool abuts.

2. A zero insertion force type socket of claim 1, wherein a member having said arcuate projections is a metal member separately formed with said base housing and said slide member and attached to each of said base housing and said slide member.

3. A zero insertion force type socket of claim 1 or 2, wherein a distance between said arcuate projection of said base housing and said arcuate projection of said slide member is shorter than length of a longer side of said tool.