LATCHING IC CONNECTOR

This invention relates to integrated circuit (IC) chip connectors and will have application to a latching IC connector.

IC chip carriers and connectors typically house an IC during burn-in testing. For certain types of chip carriers, the connector must firmly and positively lock the carrier in place by an external mechanism. One example of a prior chip connector is shown in U.S. Patent 4,502,747, which includes opposing hinged frames to lock the carrier into the connector.

A general object of the present invention is to provide an improved connector which firmly secures the IC in place during testing.

According to the present invention there is provided a connector for securing an integrated circuit; said connector including a body defining central cavity means for accepting an integrated circuit, latching means with a latch plate pivotally connected to the body for movement between a closed position overlying an integrated circuit and securing the integrated circuit to said body and an open position spaced from the integrated circuit and contact means carried by said body for

contact with leads of said integrated circuit for electrically coupling the integrated circuit to a power source; wherein said latching means further includes a hook part and an actuator pivotally connected to said latch plate for over-center locking movement between a latched position with the hook part connected with said body and the latch plate in the closed position and an unlatched position, with the actuator and hook part spaced from said body, and the latch plate in the open position.

In another aspect the invention a connector for carrying an integrated circuit during test operations comprises a body defining a central cavity to accommodate an integrated circuit, lead means extending from said body to contact said integrated circuit for electrically coupling said integrated circuit to a source of electricity and latching means with a latch plate pivotably mounted for movement between an open position permitting access to the integrated circuit and a closed position overlying the integrated circuit and securing said integrated circuit in said cavity; wherein said latching means further includes an actuator plate pivotally connected to the latch plate and a hook part

pivotally connected to said actuator plate, said latching means being pivotable between a latched position with the latch plate closed and overlying said integrated circuit and an unlatched position with the latch plate spacedfrom said connector and biasing means connected to the hook part for urging the hook part towards its latched position, wherein said hook part moves correlatively with said actuator plate in an over-center action to constitute clamp means for holding the actuator plate in its said latched position.

Preferably the over-centre locking action of the latching means is achieved by having the actuator or actuator plate pivotally connected to the latch plate on a first pivot axis and the hook part pivotally connected to the actuator or actuator plate on a second pivot axis. The first and second pivot axes shift relative to one another through an intermediate or over-center position where maximum clamping force is applied to the latch plate as the latching means moves between the latching and unlatching positions.

An IC connector in accordance with the invention may be latched and unlatched with one hand and can accommodate leadless IC chips or IC chips with leads.

An IC connector in accordance with the invention can heighten the clamping force on the IC carrier from the force imparted to the latch actuator.

The invention may be understood more readily, and

Accordingly, it is an object of this invention to provide an improved connector which firmly secures the IC in place during testing.

In one aspect, the invention provides a connector for securing an integrated circuit during testing operations, said connector including a body defining central cavity means for accepting an integrated circuit, latching means for securing said integrated circuit to said body and means carried by said body in connection with leads of said integrated circuit for electrically coupling the integrated circuit to a power test source: wherein said latching means includes a hook part, and an actuator pivotally connected to said hook part, said actuator and hook part being connected for correlative movement between a latched position with the hook part contacting said body and the actuator covering said integrated circuit, and an unlatched position with the actuator and hook part spaced from said body.

In another aspect the invention provides a connector for carrying an integrated circuit during test operations, said connector comprising a body defining a central cavity to accommodate an integrated circuit, lead

means extending from said body to contact said integrated circuit for electrically coupling said integrated circuit to a source of electricity, latching means for securing said integrated circuit in said cavity, said latching means including an actuator plate pivotally connected at one end thereof to said connector adjacent one end of the connector, and a hook part pivotally connected to said actuator plate adjacent said plate one end, said actuator plate being pivotable between a latched position overlying said integrated circuit and an unlatched position spaced from said connector, said hook part moving correlatively with said actuator plate and constituting clamp means for contacting said connector body to secure the actuator plate in its said latched position.

An IC connector in accordance with the invention may be latched and unlatched with one hand and can accommodate leadless IC chips or IC chips with leads.

An IC connector in accordance with the invention can heighten the clamping force on the IC carrier from the force imparted to the latch actuator.

The invention may be understood more readily, and

various other aspect and features of the invention may become apparent, from consideration of the following description.

In the accompanying drawings a preferred embodiment of the invention has been depicted for illustrative purposes wherein:

Figure 1 is a perspective view of the IC connector of this invention with an IC carrier shown just prior to insertion.

Figure 2 is a perspective view of the IC connector with the carrier inserted and the latch in a partially closed position.

Figure 3 is a perspective view similar to Figure 2, but showing the latch in a fully closed position.

Figure 4 is a sectional view of the connector with the latch in a full open position.

Figures 5 to 8 are sectional views of the connector showing in sequence the shifting of the latch from the open position of Figure 4 through the fully closed position of Figure 8.

Figure 9 is a schematic representation of the moment created by the over-center latches.

The preferred embodiment herein described is not intended to be exhaustive or to limit the invention to the precise form disclosed. It is chosen and described to illustrate the principles of the invention and its application and practical use to enable others skilled in the art to practice its teachings.

Referring now to the drawings, reference numeral 10 generally designates the IC chip connector of this invention. Reference number 12 generally designates the chip carrier shown in the drawings, which for illustrative purposes, is shown as a typical single piece quadpack carrier for leaded IC chip 14. Carrier 12 is shown in US Patent 4,435,724, incorporated herein by reference, and includes body 16 and tabs 18 which hold the IC 14 in place for testing. Grooves (not shown) are defined in body 16 to accommodate IC leads 20 (Figs. 4-8). Slots 22 are defined in body 16 to allow for firm connection to connector 10.

Connector 10 includes a body 24 which is defined by side walls 26, 27, 28, 29 and a central opening 30. Posts 32 extend upwardly from walls 27,29 to accommodate carrier slots 22 as shown in Figs. 2 and 3. Body 24 defines grooves 34 facing center opening 30 as shown to accommodate leads 20 of chip 14. Leads 36 extend from grooves 34 to below the bottom surface 38 of body 24 for electrical connection to a PC board (not shown). Leads 20 and leads 36 are in electrical contact

when the IC 14 and carrier 12 are secured to the connector to ensure proper testing conditions.

It should be noted that the configuration of carrier 12 and the orientation of grooves 34 will depend on the configuration and leads of IC 14. The configuration and orientation illustrated does not limit the invention to those designs but is shown for purposes of description only.

Side wall 28 of connector 10 includes a catch plate 40 which defines spaced slots 42,43 as shown. Each slot 42,43 defines an upper lip 46. Opposite side wall 26 of connector 10 includes raised tabs 48. A rod 50 extends through tabs 48 and is secured stationary relative to connector 10.

Latching mechanism 52 shown in Figs. 1-3 includes latch plate 54 which has ears 56 through which rod 50 extends as shown in Fig. 1. Helical spring 58 acts to force the rotative movement of the plate 54 about rod 50. Plate 54 has a vent hole 60 aligned with connector center opening 30 when the plate is in a latched position (Fig. 3). Plate 54 also includes raised side walls 62,63 and top lips 64,65. Lips 64,65 each include opposed extensions 66,67 which project towards the center of plate 54, with an end of spring 58 housed in the space between the extension 67 and side wall 62.

A rod 68 is connected between and spans plate walls 62, 63. Actuator plate 70 is rotatably connected to rod 68 as shown in Fig.2. Actuator 70, as shown in Fig.2, includes

legs 72 which have feet 73 through which rod 68 extends and oppositely located side flanges 74,75 which bear against extensions 66,67 to secure the actuator and plate 54 in the latched position of Fig. 3. Actuator 70 also includes inclined handle part 76 to facilitate use, and a vent hole 78 which is aligned with vent hole 60 of plate 54. Springs 80 force rotative movement of actuator 70 relative to plate 54 and connector 10.

Latch hook part 82 is rotatably connected to actuator plate 70 through a rod 84 which spans actuator feet 73 and is secured thereto by retainer ring 86. Hook part 82 includes a one-piece upper portion 87 which overlies rod 84 and a depending lower hook portion 88 which includes side located peripheral hooks 90 (one shown). Spring 92 which is connected to rod 84 and bears on rod 68 biases hook part 82 in a latched position.

An actuator plate 70 rotates about rod 68, projection 94 of hook part 82 contacts plate 54 which serves to urge hook part 82 into an unlatched or loading position as shown in Fig. 5.

Figs. 4-8 show the connector 10 through a series of sectional views of its securing operations. Fig. 4 illustrates the connector 10 with latching mechanism 52 in a full open position which allows carrier 12 (with IC 14) to be placed in the connector such that IC leads 20 contact connector leads 36 as shown. Latching mechanism 52 is then

pivoted as shown in Figs. 5-8 to secure the carrier 12 for testing.

Normally, connector 10 will be secured to a PC board (not shown) before latching mechanism 52 is closed. This will allow one handed operation of the latching mechanism 52. In Fig. 5, a user (not shown) grasps actuator handle 76 and pushes in the direction of arrow 96. This action causes latch plate 54 to pivot about rod 50. As hook part 82 is lowered, the projection 94 of hook portion 88 contacts plate 54 urging the hook part 90 to position in slots 42,43 of catch plate 40.

Actuator 70 is then pivoted about rod 68 to properly position the hook part 82 as shown in Fig.6. The user then pulls actuator handle 76 in the direction of arrow 100 (Fig.7). This action pulls rod 84 and its connected hook part forward, towards rod 50 and over the center axis of the rod 68. This over-center pivoting creates a moment which is related to the ratio of the distance between the centerline of rod 68 to the end of plate 70 over the diminishing angle X as shown in Fig. 9. In the embodiment shown this ratio is approximately 18 to 1 and the force transferred from handle 76 through rods 68,84 to hook part 82 is greater than 200:1. Any workable ratio greater than 1:1 may be used. As the user continues to pivot actuator 70, the actuator 70 is secured in a snap-fit manner between side walls 62, 63 by extensions 66, 67. Due to the over-center arrangement of rods

50, 68 and 84, a user need exert only about 4 ounces of force on actuator 70 to exert a clamping force of about 75 pounds on IC carrier 12.

To disengage latch mechanism 52, the reverse of the above procedure is followed. With the latch 52 in the locked position of Fig. 8, the user pulls up on actuator plate handle 76. This causes rod 84 to shift away from rod 50 urging rod 84 over the center axis of rod 68. Projection 94 then rides on plate 54 forcing hook part 88 to move away from rod 50. When hook portion 88 disengages from slots 42,43 the latching mechanism 52 may be pivoted into the open position. The carrier 14 may then be removed from connector 10 and a new carrier inserted for IC testing.

It is understood that the above description does not limit the invention to the details given, but may be modified within the scope of the following claims.

CLAIMS

1. A connector for securing an integrated circuit; said connector including a body defining central cavity means for accepting an integrated circuit, latching means with a latch plate pivotally connected to the body for movement between a closed position overlying an integrated circuit and securing the integrated circuit to said body and an open position spaced from the integrated circuit and contact means carried by said body for contact with leads of said integrated circuit for electrically coupling the integrated circuit to a power source; wherein said latching means further includes a hook part and an actuator pivotally connected to said latch plate for over-center locking movement between a latched position with the hook part connected with said body and the latch plate in the closed position and an unlatched position, with the actuator and hook part spaced from said body, and the latch plate in the open position.

2. A connector according to Claim 1, and further comprising biasing means acting on the latching means to urge the latching means towards the unlatched position, wherein the latch plate, the actuator and the hook part

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are interconnected so that while moving from the unlatched to the latched position a maximum clamping force is applied to the latch plate in an intermediate position between the unlatched and latched positions.

3. A connector according to Claim 1 and further comprising first biasing means connected to said hook part for urging the hook part towards its latched position and second biasing means connected to said actuator for urging the actuator towards its unlatched position.

4. A connector according to Claim 3, and further comprising third biasing means connected to said latch plate for urging the latch plate towards its said unlatched position.

5. A connector according to any one of Claims 1 to 4, wherein the actuator is connected to the latch plate for pivotal movement about a first pivot axis and the hook part is connected to the actuator for pivotal movement about a second pivot axis and the first and second pivot axes are shifted relative to one another through the over-center or intermediate position when the latching means moves between the latched and unlatched positions.

6. A connector according to any one of Claims 1 to 5,

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wherein the actuator is pivotally connected to an end of said latch plate opposite another end pivotally connected to the body and the latch plate is shiftable with said actuator between the latched and unlatched position.

7. A connector according to Claim 1, wherein said hook part includes a rod spanning said actuator transverse to a direction of pivoting movement and said actuator includes an rod spanning said latch plate and positioned adjacent to and substantially parallel with said hook part rod, whereby pivoting of the actuator towards its said latched position causes said actuator rod to slide towards said hook part while bearing on said latch plate and simultaneously draws said hook part rod over a central axis of the actuator rod to increase clamping force on said hook part.

8. A connector according to any one of Claims 1 to 7 and further comprising means for detachably securing the latching means in the latched position.

9. A connector according to any one of Claims 1 to 7 and further comprising a catch plate fastened to said connector body, said catch plate defining a slot therein terminating in a lip and wherein said hook part includes

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a latch hook part contacting said lip when the hook part is in its said latched position.

10. A connector according to Claim 8, wherein said securing means includes an extension projecting from a wall of the latch plate and connectable with said actuator as the actuator is pivoted into its latched position so that said actuator is frictionally secured to the latch plate.

11. A connector for carrying an integrated circuit during test operations, said connector comprising a body defining a central cavity to accommodate an integrated circuit, lead means extending from said body to contact said integrated circuit for electrically coupling said integrated circuit to a source of electricity and latching means with a latch plate pivotably mounted for movement between an open position permitting access to the integrated circuit and a closed position overlying the integrated circuit and securing said integrated circuit in said cavity; wherein said latching means further includes an actuator plate pivotally connected to the latch plate and a hook part pivotally connected to said actuator plate, said latching means being pivotable between a latched position with the latch plate closed and

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overlying said integrated circuit and an unlatched position with the latch plate spaced from said connector and biasing means connected to the hook part for urging the hook part towards its latched position, wherein said hook part moves correlatively with said actuator plate in an over-center action to constitute clamp means for holding the actuator plate in its said latched position.

12. A connector according to Claim 11 and further comprising second biasing means connected to said actuator plate for urging the actuator plate towards its unlatched position and means connected to said latch plate for securing said actuator and hook part in their said latched positions.

13. A connector according to Claim 12 and further comprising third biasing means connected to said latch plate for urging the latch plate towards its said unlatched position.

14. A connector according to Claim 11, 12 or 13, wherein said actuator plate is pivotally connected to the latch plate on one pivot axis, said hook part is pivotally connected to said actuator plate on a second pivotal axis and the second pivot axis shifts relative to

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the one pivot axis through an over-center position as the latching means moves between the latching and unlatching positions.

15. An IC connector substantially as described with reference to, and as illustrated in, any one or more of the Figures of the accompanying drawings.

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