Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a contact shutter mechanism in an IC socket, in which a contact included in a socket body is opened and closed by vertical movement of a contact shutter member.

2. Brief Description of the Prior Art

In Japanese Patent Early Laid-open Publication No. Sho 62-160676, a socket body includes a contact shutter member supported in a high position by a contact, the contact being displaced backward by pushing down the contact shutter member against the resiliency of the contact to form a non-contacted state relative to an IC contact and to bring an IC loading portion into a released state so that an IC package can be loaded and removed, a pressing portion for exerting a backward displacement force to the contact being formed in a plane of right angles, the backward displacement being obtainable by vertically pushing down a projecting end of a rear portion of the contact with the right angle plane.

Also, the contact is displaced forward by its own restoring force and contacted with-an upper surface of the terminal of the IC package supported on a sink-and-float platform of the socket body by the restoring force and at the same time, it renders a push-up force to the contract pushing portion to hold the contact shutter member in a high position so as to be ready for the next non-contact operation.

Since the above-mentioned prior art is designed such that the IC terminal is held down from the above of the contact to hold the IC terminal in the IC socket body, means for holding the IC package in the IC socket can be simplified and, in addition to that, the contact can be displaced backward simply by pushing down the contact shutter member to cancel the catching of the IC package so that the IC package can be immediately removed or loaded again. Accordingly, it has such advantage as that it can be easily automated by using a robot. Moreover, as a stable contact can be obtained and reliability is excellent, this prior art is widely used.

While the prior art has the above-mentioned advantages, it also has the main shortcoming in that as the contact is displaced backward in the direction generally perpendicular to the vertical direction by a push-down force in the vertical direction of the contact shutter member, the push-down force is apt to become excessively large.

In a general IC socket of, for example, 40 pins, a push-down force of about 1.6kg. is required, and because of this reason, the number of IC sockets which can be pushed down at one time by using a robot and efficiency in IC measuring operation is lowered. This tendency becomes more and more significant as the number of poles is increased and the density is increased, and how to overcome this problem is now a big issue.

In Japanese Patent Early Laid-open Publication No. Sho 62-93964, it is proposed to form the contact pushing portion in an inclined surface in order to cope with the above problem. According to this proposal, although the push-down force can be reduced, the push-down stroke becomes two times or more compared with the prior art in accordance with the angle of inclination and the contact cannot only be rapidly responded but also it results in such a new problem as an insufficient dilation.

The present invention has been accomplished in order to obviate the above-mentioned problems.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a contact shutter mechanism in an IC socket which is capable of simultaneously solving the problem in the first-mentioned prior art in that the push-down force becomes excessively large and the problem in the second-mentioned problem in that the push-down stroke becomes excessively large, and in which the opening operation, i.e., the backward displacement of the contact can be performed by a limited push-down stroke and by a reduced push-down force, thereby enabling to enjoy the above-mentioned advantages of the IC socket.

In order to achieve the above-mentioned problems, there is essentially provided a contact shutter mechanism in an IC socket according to claim 1, comprising a socket body including a plurality of contacts arranged in such a manner as to be able to contact with terminals of an IC package, and a contact shutter member vertically movably disposed on said socket body and adapted to displace, when being pushed down, said contacts backward against resiliency thereof to cancel the contacted state between said terminals of said IC package and said contacts and to bring an IC loading portion into a released state, said shutter member including a contact pushing portion adapted to rendering a backward displacement force to said contacts, said contact pushing portion being formed in an inclined surface, said inclined surface being formed at a front-stage pushing portion in a gentle inclined surface and at a rear-stage pushing portion in a steep inclined surface. Both the front-stage gentle inclined surface and rear-stage steep inclined surface may be formed in linear surfaces. The front-stage gentle inclined surface may also be formed in an arcuate surface.

The contact formed of resilient material is weak in resiliency in an early stage of resilient displace-

ment and therefore, can be displaced with a small force, while the resiliency becomes stronger with the progress of displacement and therefore, a large force is required to displace the contacts. The present invention utilizes this characteristic. According to the present invention, it is designed such that the gentle inclined surface is acted on the contacts in the early stage where the resilient displacement can be performed with a small displacement force, thereby to obtain a larger backward displacement amount, while the steep inclined surface is acted on the contacts to abruptly reducing the push-down force in a region where the displacement force is increased thereafter, thereby to achieve a target displacement amount.

By this, the push-down force of the contact shutter member, as a whole, can be reduced, and a required backward displacement amount can be obtained with a limited push-down stroke.

The novel features which are considered as characteristic for the present invention are set forth in particular in the appended claims. The present invention itself, however, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a plan view showing an IC socket according to one embodiment of the present invention;
Fig. 2 is a side view, partly in section, thereof;
Fig. 3 is a sectional view of an important portion of the IC socket with an IC package already loaded therein;
Figs. 4(A), 4(B) and 4(C) are sectional views of important portions for explaining the procedure for displacing the contacts backward by pushing down a contact shutter member in sequential order, Fig. 4(A) shows one state in which a front-stage gentle inclined surface is acted to start a push-down operation and the contacts begin to separate away from IC terminals, Fig. 4(B) shows another state in which the push-down operation is further progressed and a rear-stage steep inclined surface is acted to displace the contacts backward, and Fig. 4(C) a further state in which the push-down operation is completed and the backward displacement is finished;
Figs. 5(A), 5(B) and 5(C) are sectional views of important portions showing another embodiment in such a manner as to correspond with the procedure of Figs. 4(A), 4(B) and 4(C), in which the front-stage gentle inclined surface is formed in an arcuate surface; and
Fig. 6 is a sectional view of a contact pressing portion of one stage inclination which can be used together with the contact pressing portion of two stage inclination.

DETAILED DESCRIPTION OF THE EMBODIMENT

Embodiments of the present invention will now be described in detail with reference to Figs. 1 through 5 of the accompanying drawings.

A socket body 1 has a plurality of contacts 4 which are arranged to be able to contact with a plurality of terminals 3 of an IC package 2.

The terminals 3, as shown in Fig. 3, of the IC package 2 project sideward in parallel relation with each other from opposite sides of the IC package 2, leading ends of the terminals 3 being bent twice to form a generally horizontal shape.

Each of the contacts 4, as shown in Fig. 2, has a male terminal 5 projecting downward of a socket body 1 from a stationary end 7 implanted into the socket body 1, and a curved spring piece 6 connected to an upper portion of the stationary end 7. The spring piece 6 projects forward (toward the IC package 2 side), and an upper end of the curved spring piece 6 is connected with a contact element 8. The contact element 8 projects in the projecting direction (forward) of the curved spring piece 6 and a front end thereof is formed into a contacting projection 9.

Also, a cantilever arm 10 extends backward from an upper end of the contact, that is, the contacting element 8. The cantilever arm 10 is connected at one end thereof to the contacting element 8. The other end of the cantilever arm 10 is a free end, from which a pressure receiving portion 11 projects upward, the pressure receiving portion 11 being opened and closed by a contact shutter member as will be described hereinafter.

An upper end of a projecting piece directing upward to form the pressure receiving portion 11 is established as a pressure point P_2 pushed by a contact shutter member, and a lower end of the contacting projection 9 of the contacting element 8 is established as a contacting point P_1 contacted by the terminal 3, the pressure point P_2 being located in a position higher than a horizontal line passing the contacting point P_1.

The illustrated cantilever arm 10 once extends downward from the contacting element 8 exceeding the contacting point P_1, and is then bent into a hook shape to form the upward-directing projecting piece (pressure receiving portion 11).

The contact 4 is contacted, under pressure, with an upper surface of a front end portion of the terminal 3 supported by a terminal supporting seat 16 formed at a bottom surface of an IC package loading portion 14 of the socket body 1 from the above at angles by the contacting projection 9 of the contacting element 8. As a consequence, the terminal 3 is sandwiched, under pressure, between the stationary supporting seat 16 and the contact 4, thereby to hold the IC package 2.

It may be designed such that the terminal sup-

porting seat 16 is served as an electrically contacting surface relative to the stationary terminal, and the stationary terminal forming the contacting surface is provided to the contact 4, so that the contact 4 can be contacted with upper and lower surfaces of the IC terminal.

The numeral 12 denotes a contact shutter member for exerting a downward force to the pressure receiving portion 11 of the contact 4. The contact shutter member 12 is vertically movably mounted on the socket body 1.

The contact shutter member 12, as shown in Figs. 1 and 2, has an IC accommodation window 13 at a central portion thereof. The IC loading portion 14 of the socket body 1 is formed immediately under the IC accommodation window 13. The IC loading portion 14 has a projection 15 for supporting a substrate portion of the terminal 3 of the IC package 2, so that side surfaces of the IC package 2 body or the bent stage portion of the terminal 3 can be regulated to position the IC package 2 correctly. At that time, the front end portion of the terminal 3 is supported by the terminal supporting seat 16 disposed outside the projection 15 so as to be held in a predetermined place.

The contacts 4 are arranged, side by side, along the opposite sides of the IC loading portion 14. The contacting elements 8 of the contacts 4 are accommodated in an opening portion 17 formed sideward of the terminal supporting seat 16, with the contacting projections 9 abutted against the outer surface of the terminal supporting seat 16 and held in a state accumulating a resilient force, i.e., in a preloaded state. As a result, the terminal supporting seat 16 pushes up the contacting point P_1 in the stretching direction of the curved spring piece 6.

The contact shutter member 12 includes a pair of push-down operation portions 18 disposed at both outer sides of the IC accommodation window 13. Engaging fingers 19 extend downward from the opposite side walls of the push-down operation portion 18, and the engaging fingers 19 are engaged in guide grooves 20 formed in the opposite side walls of the socket body 1, so that the contact shutter member 12 can be moved in the vertical direction along the guide groove 20. Engaging claws formed on the front ends of the engaging fingers 19 are brought into engagement with step portions formed in the upper ends of the guide grooves 20 when the contact shutter member 12 is moved upward by a predetermined amount, thereby to establish an upper dead point of the contact shutter member 12. The contact shutter member 12 is pushed up by the pressure receiving portion 11 of the contact and supported in an upper position, where the contact shutter member 12 forms a push-down waiting state.

Furthermore, partition walls 27 to be interposed between the pressure receiving portions 11 of the respective contacts 4 project downward from the push-down operation portion 18, and a pushing portion 21 for exerting a pushing force to the pressure receiving portion of the contact 4 is formed with a valley portion between the adjacent partition walls 27.

The pushing portion 21 is formed in an inclined surface directing downward, the inclined surface being of a rising gradient toward backward of the contact. Furthermore, the inclined surface is formed in a gentle inclined surface 21a at a front stage pushing portion and in a steep inclined surface 21b at a rear stage pushing portion. Fig. 4 shows one example, in which both the front stage gentle inclined surface 21a and the rear stage steep inclined surface 21b are formed in linear surfaces, and Fig. 5 shows another example, in which the front stage gentle inclined surface is formed in an arcuate surface.

As shown in Figs. 4(A), 4(B), 4(C) and 5(A), 5(B), 5(C), when a push-down force is applied to the push-down operation portion 18 in the state where the contact shutter member 12 is in the waiting position and the pushing portion 21 is moved downward in the vertical direction, the pressure point P_2 of the pressure receiving portion 11 of the contact 4 slides down the front stage gentle inclined surface 21a forming the pushing portion 21 to the rear stage steep inclined surface 21b, a larger initial backward displacement amount of the contact 4 can be obtained with a shorter push-down stroke by the push-down function of the front stage gentle inclined surface 21a, and the remaining backward displacement amount can be obtained with a reduced push-down force by the push-down function of the rear stage steep inclined surface 21b, thereby to achieve a target backward displacement amount.

That is, when a pushing force is applied to the pressure receiving portion 11, the front stage gentle inclined surface 21a acts on the pressure point P_2 to abruptly backwardly displacing the curved spring piece 6 against the resiliency of thereof, and in the meantime, the cantilever arm is displaced to achieve an initial backward displacement along an orbit starting from an upper position (starting point for applying the pushing force) passed the upper dead point on a circle about the contacting point P_1 toward backward of the dead point on the same side. Furthermore, the rear stage steep inclined surface 21b acts thereon to achieve a target displacement amount with a reduced force, thereby to surely separate the contact contacting element 8 from the terminal 3 into a non-contacted state and to bring the IC loading portion 14 into a released state. Preferably, the cantilever arm 10 and the contacting element 8 are rigid relative to the pushing force.

By utilizing the characteristic of the contact 4 formed of resilient material that the contact 4 is weak in resiliency in an initial stage and thus able to be displaced with a comparatively small force and the resiliency is increased with the progress of the displace-

ment, the present invention is designed such that a large amount of backward displacement is obtained by acting the front stage gentle inclined surface 21a to the contact 4 in the initial stage where the resilient displacement can be obtained by a comparatively small displacement force, and the push-down force is abruptly reduced by acting the rear stage steep inclined surface 21b to the contact 4 to perform the remaining displacement in the latter half stage where the resilient force is increased, thereby to achieve the target displacement amount.

By this, the push-down force of the contact shutter member 12 is reduced as a whole and a required backward displacement amount is obtained with a limited push-down stroke.

In this way, the contacting element 8 is held in a separated position so as not to be interfered with the IC package 2, and the IC loading portion 14 including the terminal supporting seat 16 is brought to a released state, and in the foregoing state, the IC package 2 is removed from or loaded on the IC loading portion 14 through the IC accommodation window 13. When the push-down force to the push-down operation portion 18 of the contact shutter member 12 is canceled, the contact shutter member 12 is pushed upward by the restoring force of the curved spring 6 and the cantilever arm 10 of the contact 4. The contact shutter member 12 is held in a position raised by a certain amount and waits for the next push-down operation again. On the other hand, the contact elements 8 of the contacts 4 are displaced forward by the restoring force and brought into contact, under a certain contact pressure, with the upper surfaces of the front end portions of the terminals 3 supported by the terminal supporting seat 16 from the above at angles. This contacting pressure is the sum of the resilient force preliminarily accumulated by the push-up force of the terminal supporting seat 16 and the resilient force generated in such a manner as to correspond to the thickness of the terminals 3.

Owing to the foregoing arrangement, the IC package 2 is sandwiched between the terminal supporting seat 16 and the contacting projection 9 of the contacting element 8 and held by the socket body 1.

When the push-down operation portion 18 of the contact shutter member 12 is further pushed down again from the foregoing state, the contact 4 is displaced backward as in the above-mentioned case to cancel the contact relation with the IC package 2 and brought to be in a non-interference state. In that state, the IC package 2 is loaded in and removed from the IC socket.

The push-down operation of the contact shutter member 12 can be performed by vertical motion of manipulation of a robot.

In the above-mentioned embodiments, the contacts 4 are arranged, side by side, along the opposite two sides of the IC loading portion 14 of the socket body 1. However the present invention is likewise applicable to a case where the contacts 4 are along the four sides of the IC loading portion 14 of the socket body 1. In that case, the push-down operation portions 18 of the contact shutter members 12 can be disposed to four places around the IC accommodation window in such a manner as to correspond to the contacts 4.

As a preferred embodiment, it may be designed such that the pushing portions 21 each having the front stage gentle inclined surface 21a and the rear stage steep inclined surface 21b are disposed in such a manner as to correspond to each of the contacts 4, or the pushing portions 21 each having the two stage inclined surface are disposed in such a manner as to correspond to a limited number of contacts 4 among the total contacts 4. In the latter case, the conventional pushing portions 21' each having one stage inclined surface 21c are employed relative to other contacts 4 as shown in Fig. 6, so that the pushing portion 21 of a two stage inclined surface and the pushing portion 21' of a one stage inclined surface are used together.

According to the present invention, by utilizing the characteristic of the contact formed of resilient material that the contact is weak in resiliency in an initial stage and thus able to be displaced with a comparatively small force and the resiliency is increased with the progress of the displacement, a large amount of backward displacement is obtained by acting the front stage gentle inclined surface 21a to the contact 4 in the initial stage where the resilient displacement can be obtained by a comparatively small displacement force, and the push-down force is abruptly reduced by acting the rear stage steep inclined surface 21b to the contact 4 to perform the remaining displacement in the latter half stage where the resilient force is increased, thereby to achieve the target displacement amount. By this, the push-down force of the contact shutter member can be reduced as a whole and a required amount of backward displacement can be obtained with a limited push-down stroke.

In this way, the present invention simultaneously solves the problem that the push-down force becomes excessively large as in the first prior art and the problem that the push-down stroke becomes excessively large as in the second prior art, and achieves the object that the contacts can be displaced backward with a limited push-down stroke and with a reduced push-down force. As a consequence, the present invention can fully enjoy the above-mentioned advantages of the IC socket.

Preferred embodiments of the present invention have been disclosed for illustrative purposes.

Claims

1. A contact shutter mechanism in an IC socket comprising a socket body (1) including a plurality of contacts (4) arranged in such a manner as to be able to contact with terminals (3) of an IC package (2), and a contact shutter member (12) vertically movably disposed on said socket body and adapted to displace, when being pushed down, said contacts backward against resiliency thereof to cancel the contacted state between said terminals of said IC package and said contacts and to bring an IC loading portion (14) into a released state, said shutter member including a contact pushing portion (12) adapted to rendering a backward displacement force to said contacts, said contact pushing portion being formed in an inclined surface, said inclined surface being formed at a front-stage contact pushing portion (21a) in a gentle inclined surface and at a rear-stage contact pushing portion (21b) in a steep inclined surface.

2. A contact shutter mechanism in an IC socket as claimed in claim 1, wherein both said front-stage gentle inclined surface and rear-stage steep inclined surface are formed in linear surfaces.

3. A contact shutter mechanism in an IC socket as claimed in claim 1, wherein said front-stage gentle inclined surface is formed in an arcuate surface.

Patentansprüche

1. Aufnahme für IC-Packungen mit einem Unterbrechermechanismus, bestehend aus einem Sockel (1) mit einer Mehrzahl von dem Sockel (1) in einer Weise zugeordneten Kontakten (4), die eine Kontaktierung durch Anschlußkontakte (3) einer IC-Packung (2) ermöglicht und einer auf dem Sockel (1) aufsitzenden, gegenüber dem Sockel (1) anstellbaren Drucktaste (12), die im angestellten Zustand den Kontaktbereich (8/9) der in den Sockel (1) eingelagerte Kontakte (4) gegen eine den Kontakten (4) eigene Rückstellkraft anhebt und so den Kontakt mit den Anschlußkontakten (3) der IC-Pakkung (2) unterbricht und auf diese Weise den Aufahmebereich (14) des Sockels (1) spannungsfrei macht, wobei die Drucktaste (12) einen Stößel (21) aufweist, der geeignet ist, auf die Sockelkontakte (4) eine ein Abheben der Kontaktbereiche (8, 9) bewirkende Kraft zu übertragen mit einer gegen das freie Ende eines Kragarms (11) der Kontakte (4) zur Einwirkung kommenden geneigt zum freien Ende des Kragarms (11) verlaufenden Wirkfläche, die sich aus einem frontseitigen, flach ansteigenden Bereich (210) und einem sich daran anschließenden steiler einsteigenden Bereich (216) zusammensetzt.

2. Aufnahme für IC-Packungen nach Anspruch 1, dadurch gekennzeichnet, daß sowohl der frontseitige flach ansteigende Bereich (21a) als auch der sich daran anschließende steiler ansteigende Bereich (21b) der Wirkfläche des Drucktastenstößels (21) einen linearen Verlauf nehmen.

3. Aufnahme für IC-Packungen nach Anspruch 1, dadurch gekennzeichnet, daß der frontseitige flach ansteigende Bereich (21a) der Wirkfläche des Drucktastenstößels (21) einen bogenförmigen Verlauf nimmt.

Revendications

1. Mécanisme pour relever les contacts dans un socle de circuit intégré comportant un corps de socle (1) incluant une pluralité de contacts (4) disposés de manière telle qu'ils sont capables de contacter des bornes (3) d'un boîtier de circuit intégré (2), et un élément de relevage de contacts (12) mobile verticalement disposé sur le corps de socle et conçu pour déplacer, lorsqu'il est poussé vers le bas, les contacts de manière élastique vers l'arrière pour annuler l'état branché entre les bornes du boîtier de circuit intégré et les contacts, et pour amener une partie de chargement de circuit intégré (14) dans un état débranché, l'élément de relevage comportant un secteur de poussée des contacts (21) destiné à appliquer une force de déplacement vers l'arrière aux contacts, le secteur de poussée des contacts étant formé d'une surface inclinée, laquelle surface inclinée est formée d'une portion de poussée des contacts frontale (21a) ayant une surface inclinée en pente douce et d'une portion de poussée arrière (21b) ayant une surface inclinée en pente raide.

2. Mécanisme pour relever les contacts dans un socle de circuit intégré selon la revendication 1, caractérisé en ce qu'à la fois la surface inclinée frontale en pente douce et la surface inclinée arrière en pente raide sont constituées de surface linéaire.

3. Mécanisme pour relever les contacts d'un socle de circuit intégré selon la revendication 1, caractérisé en ce que la surface inclinée frontale en pente douce est constituée d'une surface incurvée.