

ELECTRICAL INTERCONNECT PIN

Field Of Invention

The present field of invention generally relates to electrical interconnectors, such as a pin, for electrically communicating a lead of an integrated circuit device with a conductive terminal for effecting test analysis of the integrated circuit device.

Background

There exist many applications for effecting electrical connection between two conductors. An important application is for effecting electrical interconnection between leads of integrated circuit devices and terminals of printed circuit boards. The purpose of providing such electrical interconnection is for performing test analysis of integrated circuit devices, thus evaluating performance of integrated circuit devices.

U.S. Pat. No. 5,069,629 to Johnson discloses an electrical interconnect contact system having a housing with generally planar contacts for electrically interconnecting a lead of an integrated circuit device to a terminal on a printed circuit board spaced at a distance from the lead of the device. Troughs are provided along two surfaces of the housing with elements received in the troughs. The contacts are received in slots provided by the housing and are shaped to engage the elements provided in the troughs. One end of the contact is for contacting the lead of the device to be tested while the other end of the contact is for contacting the terminal. Contact with the lead of the device and the terminal is effected through a wiping action. However, the wiping action, although providing effective contact during initial use, has resulted in wearing of the terminal on the printed circuit board. Hence, the printed circuit board has to be replaced, which increases testing costs, as the printed circuit board is costly.

U.S. Pat. No. 6,244,874 to Tan discloses an electrical contact for integrated circuit device testing, which provides good electrical contact without involving the wiping action as disclosed in U.S. Pat. No. 5,069,629 to Johnson. The electrical contact comprises a first and second arm formed into a generally C-shaped segment and a hook segment protruding from the C-shaped segment in a direction generally opposite

the second arm. The hook segment is adapted for engaging a securing element. The first and second arm is connected via a resilient neck and the electrical contact is adapted for use with an apparatus for electrically interconnecting a lead of a test device to a terminal spaced at a distance from the lead. However, during the integrated circuit device testing, the interaction between the electrical contact and the securing element causes wearing of the securing element. Thus, the securing element needs to be replaced.

Therefore, there is a need for an electrical interconnect pin for electrically communicating a lead of an integrated circuit device with a conductive terminal for effecting test analysis of the integrated circuit device, which addresses at least one of the aforementioned disadvantages.

Summary

The present embodiment of the invention disclosed herein provides an electrical interconnect pin for electrically communicating a lead of an integrated circuit device with a terminal for effecting test analysis of the integrated circuit device.

In accordance with a first aspect of the invention, a pin comprising a head segment and a body segment for electrically communicating a lead of an integrated circuit device with a conductive terminal is disclosed. The head segment is shaped and dimensioned for abutting the lead of the integrated circuit device. The head segment is further shaped and dimensioned for engaging a support element for support thereby, in which the support element is resilient. The body segment extends from the head segment and terminates at a free end. A portion of the body segment is shaped and dimensioned for contacting the conductive terminal. Further, the body segment is resilient and at least a portion of the body segment is curved. The body segment resiliently deflects in response to displacement of the head segment towards the conductive terminal during abutment with the lead, in which the head segment and the body segment electrically connects the lead with the conductive terminal.

In accordance with a second aspect of the invention, a method for electrically communicating a lead of an integrated circuit device with a conductive terminal is

disclosed. The method comprises providing a pin having a head segment and a body segment. The head segment is shaped and dimensioned for abutting the lead of the integrated circuit device. The head segment is further shaped and dimensioned for engaging a support element for support thereby, in which the support element is resilient. The body segment extends from the head segment and terminates at a free end. A portion of the body segment is shaped and dimensioned for contacting the conductive terminal. Further, the body segment is resilient and at least a portion of the body segment being curved. The method further comprises contacting the body segment to the conductive terminal. The method also comprises abutting the lead to the head segment. The body segment resiliently deflects in response to displacement of the head segment towards the conductive terminal during abutment with the lead, in which the head segment and the body segment electrically connects the lead with the conductive terminal.

In accordance with a third aspect of the invention, an interconnect system comprising a support element, a pin and a base is disclosed. The pin comprises a head segment and a body segment. The head segment is shaped and dimensioned for abutting a lead of an integrated circuit device. The head segment is further shaped and dimensioned for engaging the support element for support thereby, in which the support element is resilient. The body segment extends from the head segment and terminates at a free end. A portion of the body segment is shaped and dimensioned for contacting the conductive terminal. Further, the body segment is resilient and at least a portion of the body segment is curved. The base is disposed between the body segment and the conductive terminal for supporting a portion of the free end of the body segment. The body segment resiliently deflects in response to displacement of the head segment towards the conductive terminal during abutment with the lead, in which the head segment and the body segment electrically connects the lead with the conductive terminal.

In accordance with a fourth aspect of the invention, a pin comprising a head segment and a body segment for electrically communicating a lead of an integrated circuit device with a conductive terminal is disclosed. The head segment is shaped and dimensioned for abutting the lead of the integrated circuit device. The body segment

extends from the head segment and terminates at a free end. A portion of the body segment is shaped and dimensioned for contacting the conductive terminal. Further, the body segment is resilient and at least a portion of the body segment is curved. The body segment resiliently deflects in response to displacement of the head segment towards the conductive terminal during abutment with the lead, in which the head segment and the body segment electrically connects the lead with the conductive terminal.

Brief Description Of The Drawings

10 An embodiment of the invention is described hereinafter with reference to the following drawings, in which:

FIG. 1 shows a front elevation of a pin according to an embodiment of the invention;

15 FIG. 2 shows a front elevation of the pin of FIG. 1 received in a housing with a head segment thereof being displaced towards a conductive terminal of an electrical circuit board; and

FIG. 3 shows a front elevation of the pin of FIG. 1 received in the housing of FIG. 2 with the head segment thereof being biased away from the conductive terminal.

Detailed Description

An electrical interconnect pin for electrically communicating a lead of an integrated circuit device with a conductive terminal for effecting test analysis of the integrated circuit device is described hereinafter for addressing at least one of the aforementioned disadvantages.

For purposes of brevity and clarity, the description of the invention is limited hereinafter to applications relating to electrical interconnect pins. This however does not preclude various embodiments of the invention from other applications. The fundamental inventive principles of the embodiments of the invention shall remain common throughout the various embodiments.

An embodiment of the invention described in the detailed description provided hereinafter is in accordance with Fig. 1 to Fig. 3 of the drawings, in which like elements are numbered with like reference numerals.

5 With reference to Fig. 1 to Fig. 3, an electrical interconnect pin 20 (hereinafter known as pin 20) is described according to an embodiment of the invention. The pin 20 generally comprises a head segment 22 and a body segment 24. The body segment 24 extends from the head segment 22 and terminates at a free end 26. Further, the head segment 22 and the body segment 24 are substantially planar. Alternatively, the head
10 segment 22 and the body segment 24 are portions of a wire.

The head segment 22 comprises a pair of humps 28 arranged at one portion of the head segment 22. Further, the head segment 22 comprises a recess 30 disposed at another portion of the head segment 22. Alternatively, more than two humps are
15 formable on the head segment 22.

The body segment 24 is resilient and comprises a first curved portion 32, a second curved portion 34 and a third curved portion 36. The first curved portion 32 is for connecting the head segment 22 to the body segment 24. The second curved portion
20 34 is for connecting the first curved portion 32 to the third curved portion 36, while the third curved portion 36 extends towards the free end 26 of the body segment 24. The body segment 24 further comprises a support portion 38 adjacent to the free end 26, and a protrusion 40 that extends from the support portion 38 and away from the head segment 22.

25 The head segment 22 is shaped and dimensioned for engaging a support element 42 for being supported. The support element 42 is resilient and is one of a plastic and an elastomer. The support element 42 is preferably elongated. Further, the support element 42 is preferably circularly shaped and has a pre-determined shore hardness
30 for operatively supporting the head segment 22. The support element 42 is received in the recess 30 and is insertable through the opening of the recess 30. When the support element 42 is received in the recess 30, the recess 30 substantially surrounds a

portion of the support element 42 and cannot be easily removed through the opening of the recess 30.

5 A portion of the body segment 24 is shaped and dimensioned for contacting a
conductive terminal 44. The protrusion 40 is shaped for passing through an
aperture formed in a base for locating the protrusion 40 to the base along a plane, in
which the base is disposed between the support portion 38 and the conductive
terminal 44 (not shown). When inserted through the aperture of the base, the
protrusion 40 abuts the conductive terminal 44 for contacting the body segment 24
10 therewith. Further, a portion of the free end 26 of the body segment 24 is
substantially straight for being supportable by the base.

The support element 42 and the conductive terminal 44 form part of a housing 46 with
the pin 20 being for use with the housing 46 as illustrated in Fig. 2 and Fig. 3. The
15 housing 46 comprises a first surface 48 and a second surface 50, with the second
surface 50 in contact with an electrical circuit board 52. The housing 44 further
comprises a frame 54, a pin holder 56, a pin holder cover 58 and a support bar 60.

The frame 54 is for holding and securing the pin holder 56 and is preferably made of
20 metallic wear resistant material for increasing the durability of the frame 54. The
frame 54 preferably comprises holes for guiding a plunger and pockets with a pre-
determined depth for preventing the plunger from plunging more than a pre-defined
distance (not shown).

25 The pin holder 56 is coupled to the frame 54 by means of screws (not shown). The
pin holder 56 comprises a slot and a hollow portion substantially perpendicular to the
slot for housing the support element 42 (not shown) and is preferably made of
insulating material. The pin 20 is received in the slot and is secured in position by the
support element 42. The bottom portion of the pin holder 56 preferably comprises a
30 slit for holding and securing the protrusion 40 of the body segment 24 for impeding
mobility of the pin 20 (not shown).

The pin holder cover 58 is disposed above the pin holder 56 for covering the body segment 24 and for further securing the pin 20 in the pin holder 56. The pin holder cover 54 is preferably made of insulating material.

- 5 The support bar 60 is disposed at the second surface 50 of the housing 46 for supporting the pin holder 56. The support bar 60 also functions as an insulator between the frame 54 and the electrical circuit board 52.

During test analysis of an integrated circuit device 62, the integrated circuit device 62
 10 is placed above the pin 20. The testing process involves providing and applying a force on a lead 64 of the integrated circuit device 62 (not shown). When the force is applied to the lead 64, the pin 20 is brought to a test position as shown in Fig. 2, in which the lead 64 abuts the head segment 22 of the pin 20 for contacting the humps 28 and displaces towards the conductive terminal 44. The body segment 24 resiliently
 15 deflects in response to displacement of the head segment 22 towards the conductive terminal 44 during abutment with the lead 64. The force is for effecting sequential contact between the lead 64 and the humps 28 for abrading at least a portion of the lead 64. In the test position, the pin 20 electrically communicates the lead 64 with the conductive terminal 44 for effecting test analysis of the integrated circuit device 62.

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When the force is removed from the lead 64, the pin 20 is brought to a rest position as shown in Fig. 3, in which the lead 64 disengages the head segment 22 and the body segment 24 is biased away from the conductive terminal 44. In the rest position, the pin 20 does not electrically communicate the lead 64 with the conductive terminal 44.

- 25 The integrated circuit device 62 is then removed and test analysis of another integrated circuit device can be performed by means of the testing process mentioned above.

The lead 64 typically comprises a layer of oxide deposited on the surface of the lead
 30 64 due to occurrence of oxide build-up (not shown). As the oxide layer present on the surface of the lead 64 may affect the test analysis of the integrated circuit device 62 by affecting conductance of the lead 64, it is important to remove the oxide layer from the lead 64 during the test analysis for obtaining accurate test readings. The humps 28

are for abrading to thereby remove the deposited oxide layer on the surface of at least a portion of the lead 64 when the humps 28 sequentially contact the lead 64. Further, the support element 42 comprises a grooved portion for collecting the abraded oxide layer from the lead 64 for preventing the abraded oxide layer from being deposited on the pin 20 during the testing process (not shown).

The second curved surface 34 and the third curved surface 36 (hereinafter known as radii 34, 36) are for accommodating displacement of the head segment 24 towards the conductive terminal 44 by enabling distributed flexure of the body segment 24 of the pin 20. The radii 34, 36 are shaped for absorbing the force applied during the testing process and facilitating deflection of the body segment 24 from the test position to the rest position. Further, the protrusion 40 is preferably fixed to the conductive terminal 44 of the electrical circuit board 52 for preventing the pin 20 from digging into and damaging the electrical circuit board 52 during the testing process.

The combination of the head segment 22 and the body segment 24 and their inter-configuration provides good electrical communication between the lead 64 and the conductive terminal 44 with minimised wearing of the support element 42 and the electrical circuit board 52 during the testing process. As wearing of the support element 42 and wearing of the electrical circuit board 52 during the testing process are minimised, the frequency of replacing the support element 42 and the electrical circuit board 52 is substantially reduced.

In the foregoing manner, an electrical interconnect pin for electrically communicating a lead of an integrated circuit device with a terminal for effecting test analysis of the integrated circuit device is described according to one embodiment of the invention for addressing at least one of the foregoing disadvantages. Although only one embodiment of the invention is disclosed, the invention is not to be limited to specific forms or arrangements of parts so described and it will be apparent to one skilled in the art in view of this disclosure that numerous changes and/or modification can be made without departing from the scope and spirit of the invention.

Claims

1. A pin comprising:

a head segment being shaped and dimensioned for abutting a lead of an integrated circuit device, the head segment further being shaped and dimensioned for engaging a support element for support thereby, the support element being resilient; and

a body segment extending from the head segment and terminating at a free end, a portion of the body segment being shaped and dimensioned for contacting a conductive terminal, the body segment being resilient and at least a portion of the body segment being curved,

whereby the body segment resiliently deflects in response to displacement of the head segment towards the conductive terminal during abutment with the lead,

wherein the head segment and the body segment electrically communicates the lead with the conductive terminal.

2. The pin as in claim 1, a portion of the free end of the body segment being substantially straight for being supportable by a planar surface.

3. The pin as in claim 1, the body segment comprising:

a support portion adjacent the free end of the body segment; and

a protrusion extending from the support portion and away from the head segment, the protrusion for contacting the conductive terminal.

4. The pin as in claim 3, the protrusion being shaped for passaging through an aperture formed in a base for locating the protrusion to the base along a plane.

5. The pin as in claim 4, wherein the base is disposed between the support portion of the body segment and the conductive terminal.

6. The pin as in claim 1, wherein the support element is one of a plastic and an elastomer.

7. The pin as in claim 1, the head segment comprising:
a recess being shaped for receiving the support element therethrough and
for positioning a portion of the head segment between the lead and the support
element, wherein when the support element is received through the recess, the
5 recess substantially diametrically surrounds a portion of the support element.
8. The pin as in claim 1, the head segment comprising:
a plurality of humps, the plurality of humps sequentially contacting the
lead when the lead abuts the head segment and is displaced towards the
10 conductive terminal for abrading at least a portion of the lead.
9. The pin as in claim 1, the head segment and the body segment being
substantially planar.
- 15 10. The pin as in claim 1, the body segment further being shaped with a plurality
of radii.
11. A method comprising:
providing a pin having a head segment and a body segment, the head
20 segment being shaped and dimensioned for abutting a lead of an integrated
circuit device, the head segment further being shaped and dimensioned for
engaging a support element for support thereby, the support element being
resilient, the body segment extending from the head segment and terminating
at a free end, a portion of the body segment being shaped and dimensioned for
25 contacting a conductive terminal, the body segment being resilient and at least
a portion of the body segment being curved;
contacting the body segment to the conductive terminal; and
abutting the lead to the head segment,
whereby the body segment resiliently deflects in response to
30 displacement of the head segment towards the conductive terminal during
abutment with the lead,
wherein the head segment and the body segment electrically
communicates the lead with the conductive terminal.

12. The method as in claim 11, a portion of the free end of the body segment being substantially straight for being supportable by a planar surface.
- 5 13. The method as in claim 11, the body segment comprising:
a support portion adjacent the free end of the body segment; and
a protrusion extending from the support portion and away from the head segment, the protrusion for contacting the conductive terminal.
- 10 14. The method as in claim 13, the protrusion being shaped for passaging through an aperture formed in a base for locating the protrusion to the base along a plane.
- 15 15. The method as in claim 14, wherein the base is disposed between the support portion of the body segment and the conductive terminal.
16. The method as in claim 11, wherein the support element is one of a plastic and an elastomer.
- 20 17. The method as in claim 11, the head segment comprising:
a recess being shaped for receiving the support element therethrough and for positioning a portion of the head segment between the lead and the support element, wherein when the support element is received through the recess, the recess substantially diametrically surrounds a portion of the support element.
- 25 18. The method as in claim 11, the head segment comprising:
a plurality of humps, the plurality of humps sequentially contacting the lead when the lead abuts the head segment and is displaced towards the conductive terminal for abrading at least a portion of the lead.
- 30 19. The method as in claim 11, the head segment and the body segment being substantially planar.

20. The method as in claim 11, the body segment further being shaped with a plurality of radii.

21. An interconnect system comprising:

5 a support element, the support element being resilient;

a pin having a head segment and a body segment, the head segment being shaped and dimensioned for abutting a lead of an integrated circuit device, the head segment further being shaped and dimensioned for engaging the support element for support thereby, the body segment extending from the head segment and terminating at a free end, a portion of the body segment being shaped and dimensioned for contacting a conductive terminal, the body segment being resilient and at least a portion of the body segment being curved; and

10 a base disposed between the body segment and the conductive terminal for supporting a portion of the free end of the body segment,

whereby the body segment resiliently deflects in response to displacement of the head segment towards the conductive terminal during abutment with the lead,

15 wherein the head segment and the body segment electrically communicates the lead with the conductive terminal.

22. A pin comprising:

a head segment being shaped and dimensioned for abutting a lead of an integrated circuit device; and

25 a body segment extending from the head segment and terminating at a free end, a portion of the body segment being shaped and dimensioned for contacting a conductive terminal, the body segment being resilient and at least a portion of the body segment being curved,

30 whereby the body segment resiliently deflects in response to displacement of the head segment towards the conductive terminal during abutment with the lead,

wherein the head segment and the body segment electrically communicates the lead with the conductive terminal.

23. The pin as in claim 22, the head segment and the body segment being substantially planar.
24. The pin as in claim 22, the head segment and the body segment being a wire.