

DESCRIPTION

SOCKET ATTACHING STRUCTURE AND SPRING MEMBER

Field

[0001] The present invention relates to a socket
5 attaching structure in a test socket for use in an
electrical continuity test or a performance characteristic
test performed on a test object such as a semiconductor
integrated circuit, a liquid crystal panel and the like.
The present invention also relates to a spring member
10 included in the socket attaching structure.

Background

[0002] It is a conventional practice that, when an
electrical continuity test or a performance characteristic
test is performed on a test object such as a semiconductor
15 integrated circuit, a liquid crystal panel and the like, a
test socket (hereinafter referred to as a socket) that
accommodates a plurality of contact probes be used so that
electrical connection may be established between the test
object and a signal processing apparatus including a
20 circuit substrate that outputs test signals. In sockets,
itches between contact probes have been narrowed owing to
the recent progress in further highly integrating and
further miniaturizing semiconductor integrated circuits and
liquid crystal panels. Owing to the narrowing of pitches,
25 technologies applicable to highly integrated and
miniaturized test objects have been in progress.

[0003] A conventional socket includes a plurality of
contact probes, a probe holder that accommodates and
supports the contact probes in accordance with a
30 predetermined pattern, and a holder member provided on the
circumference of this probe holder and configured to
prevent positional shift of a semiconductor integrated
circuit that makes contact with the contact probes when a

test is performed. The socket is fixed to a circuit substrate of a signal processing apparatus with the holder member screwed thereto, thereby being enabled to electrically connect to the contact probes (for example, refer to Patent Literature 1).

Citation List

Patent Literature

[0004] Patent Literature 1: Japanese Patent Application Laid-open No. 2010-3511

10 Summary

Technical Problem

[0005] In this connection, a signal processing apparatus may have a plurality of circuit substrates in accordance with the types of semiconductor integrated circuits. In this case, it is necessary to individually attach the aforementioned sockets on the signal processing apparatus (on the respective circuit substrates) in accordance with the types of semiconductor integrated circuits that are test objects. The sockets are fixed by being screwed to the substrates, and there has been a concern that the work for attaching and detaching the sockets may take long. In addition, this work is labor-intensive. Therefore, a technique that enables attachment and detachment of sockets to and from circuit substrates has been called for.

25 [0006] The present invention has been made in view of the above circumstances, and an object is to provide a socket attaching structure and a spring member that enable easy attachment and detachment of a socket to and from a circuit substrate.

30 Solution to Problem

[0007] To solve the above-described problem and achieve the object, a socket attaching structure according to the present invention attaches a socket including a plurality

of contact probes, a probe holder, and a holder member to a substrate, the contact probes each being configured to make contact with the substrate and a contact receiving body on respective longitudinally opposite ends of the contact
5 probe, the probe holder being configured to accommodate and retain the contact probes in accordance with a predetermined pattern, the holder member being disposed around the probe holder. The socket attaching structure includes: a plurality of supporting members extending from
10 a main surface of the substrate and configured to be individually inserted through insertion holes provided in the holder member; and a plate-like spring member configured to be attached to the supporting members while biasing the holder member toward the substrate with the
15 holder member placed on the substrate, and the spring member includes first through-holes penetrating the spring member in a plate thickness direction thereof and capable of having the corresponding supporting members inserted therethrough, and a fixing portion forming a part of a side
20 wall of at least one of the first through-holes and configured to retain and fix a corresponding one of the supporting members.

[0008] Moreover, in the socket attaching structure according to the present invention, the spring member
25 includes a base portion forming a substantially belt-like shape, and two arm portions extending, on a plane that a plate surface passes through, through from longitudinally opposite ends of the base portion in a direction substantially perpendicular to the longitudinal direction
30 of the base portion, the arm portions each having a middle portion thereof curved in an arch, the spring member forms a substantially C-like shape in a plan view from a direction perpendicular to the plate surface of the base

portion, and the first through-holes are provided to the respective arm portions.

[0009] Moreover, in the socket attaching structure according to the present invention, each of the supporting
5 members is a columnar shape and includes, at a distal end thereof, a small-diameter portion having a diameter smaller than a diameter of other portions, each of the first through-hole includes a first hole portion having a diameter larger than a largest diameter of the supporting
10 members, and a second hole portion extending in a uniform width from an end portion of the first hole portion toward one side of each of the arm portions that is different from a distal end of the arm portion, the width being substantially equal to the diameter of the small-diameter
15 portion, and the fixing portion is a catch portion formed by slits extending from a side wall of the second hole portion, the catch portion being configured to seize the supporting member.

[0010] Moreover, in the socket attaching structure
20 according to the present invention, each of the two arm portions is provided with a bent portion formed by bending an edge portion thereof on one side opposite to another side that faces the other one of the arm portions.

[0011] Moreover, in the socket attaching structure
25 according to the present invention, the holder member has screw holes into which screws are capable of being screwed, each of the arm portions has a second through-hole penetrating the arm portion in a plate thickness direction thereof in accordance with a corresponding one of the screw
30 holes, and the holder member and the spring member are joined together with the screws inserted into the second through-holes and screwed into the screw holes.

[0012] Moreover, in the socket attaching structure

according to the present invention, the holder member includes two cutout portions provided on opposite sides having outer edges on an upper surface side of the holder member and obtained by cutting out the holder member along the outer edges, the cutout portions being configured to serve as a guide for a location on the holder member where the spring member is to be attached.

[0013] Moreover, a spring member according to the present invention is used in attaching a socket including a plurality of contact probes, a probe holder, and a holder member to a substrate, the contact probes each being configured to make contact with the substrate and a contact receiving body on respective longitudinally opposite ends of the contact probe, the probe holder being configured to accommodate and retain the contact probes in accordance with a predetermined pattern, the holder member being disposed around the probe holder. The spring member includes: first through-holes formed therein penetrating the spring member in a plate thickness direction thereof and configured to have a plurality of supporting members individually inserted therethrough while keeping the holder member placed on the substrate in a state receiving a load that biases the holder member toward the substrate, the supporting members extending from a main surface of the substrate and being configured to be individually inserted through insertion holes provided in the holder member; and a fixing portion forming a part of a side wall of at least one of the first through-holes and configured to retain and fix a corresponding one of the supporting members.

Advantageous Effects of Invention

[0014] According to the present invention, the effect of enabling easy attachment and detachment of sockets to circuit substrates is achieved.

Brief Description of Drawings

[0015] FIG. 1 is a perspective view illustrating a schematic configuration of a socket attaching structure according to an embodiment of the present invention.

5 FIG. 2 is a local sectional view illustrating the configuration of the main part in the socket attaching structure according to the embodiment of the present invention.

FIG. 3 is a local sectional view illustrating the configuration of the main part in the socket attaching structure according to the embodiment of the present invention when a tested is performed on a semiconductor integrated circuit.

10 FIG. 4 is a perspective view illustrating the configuration of the main part in the socket attaching structure according to the embodiment of the present invention.

FIG. 5 is a perspective view illustrating the configuration of the main part in the socket attaching structure according to the embodiment of the present invention.

20 FIG. 6 is a perspective view illustrating the configuration of the main part in the socket attaching structure according to the embodiment of the present invention.

FIG. 7 is a plan view illustrating the configuration of the main part of a leaf spring illustrated in FIG. 6.

FIG. 8 is a perspective view illustrating the configuration of the main part of the socket attaching structure according to the present embodiment.

30 FIG. 9 is a local sectional view illustrating the configuration of the main part in the socket attaching structure according to the embodiment of the present

invention.

FIG. 10 is a perspective view illustrating the configuration of the main part of the socket attaching structure according to the embodiment of the present invention.

FIG. 11 is a local sectional view illustrating the configuration of the main part in the socket attaching structure according to the embodiment of the present invention.

FIG. 12 is a perspective view illustrating the configuration of the main part of the socket attaching structure according to the embodiment of the present invention.

FIG. 13 is a local sectional view illustrating the configuration of the main part in the socket attaching structure according to the embodiment of the present invention.

Description of Embodiments

[0016] An embodiment for carrying out the present invention is described below in detail with the drawings. The following embodiment is not intended to limit the present invention. In addition, the drawings that the following description refers to merely schematically illustrate shapes, sizes, and positional relations to the extent that details of the present invention can be understood. That is, the present invention is not limited exclusively to the shapes, sizes, and positional relations that are illustrated in the drawings.

[0017] FIG. 1 is a perspective view illustrating a schematic configuration of a socket attaching structure according to an embodiment of the present invention. A socket 1 illustrated in FIG. 1 is an apparatus for use in performing an electrical characteristic test on a

semiconductor integrated circuit 100 that is a test object, and is an apparatus that electrically connects the semiconductor integrated circuit 100 and a circuit substrate 200 that outputs test signals to the semiconductor integrated circuit 100.

[0018] The socket 1 includes: a plurality of contact probes 2 (hereinafter referred to simply as "probes 2"); a probe holder 3; a holder member 4; and a leaf spring 5 (a spring member). Each of the contact probes 2 makes contact with one electrode (a contact receiving body) of the semiconductor integrated circuit 100 on one longitudinally end side of the contact probe 2, the one electrode being a contact receiving body, and also makes contact with a different electrode of the circuit substrate 200 on the other longitudinally end side thereof. The probe holder 3 accommodates and retains the probes 2 in accordance with a predetermined pattern. The holder member 4 is provided around the probe holder 3 and prevents positional shift of a semiconductor integrated circuit 100 that makes contact with the probes 2 when a test is performed. The leaf spring 5 is attached to the upper surface of the holder member 4 and presses the holder member 4 against the circuit substrate 200, so that the holder member 4 and the circuit substrate 200 are fixed to each other.

[0019] FIG. 2 is a view illustrating details of the structures of the respective probes 2 accommodated in the probe holders 3. Each of the probes 2 illustrated in FIG. 2 includes a first plunger 21, a second plunger 22, and a pipe member 23. The first plunger 21 makes contact with a connecting electrode of the semiconductor integrated circuit 100 when a test is performed on the semiconductor integrated circuit 100. The second plunger makes contact with an electrode of the circuit substrate 200 provided

with a test circuit. The pipe member 23 covers the outer circumference of a spring member (not illustrated) interposed between the first plunger 21 and the second plunger 22. The first plunger 21, the second plunger 22, and the pipe member 23, which constitute the probe 2, have the same axis. When the probe 2 is brought into contact with the semiconductor integrated circuit 100, the spring member inside the pipe member 23 absorbs the shock on the connecting electrode of the semiconductor integrated circuit 100 by expanding and contracting in the direction of the axis of the probe 2, and imposes loads to the semiconductor integrated circuit 100 and the circuit substrate 200. The first plunger 21 has a plurality of acute end portions each having a tapered shape for making contact with, for example, a connecting electrode 101 (refer to FIG. 3) of the semiconductor integrated circuit 100 that has a semispherical shape.

[0020] The probe holder 3 is formed of an insulating material such as resin, machinable ceramics, or silicon, and is constructed of a first member 31 and a second member 32 layered on each other that are found in the upper surface side and in the lower surface side, respectively, in FIG. 2. The first member 31 and the second member 32 have the same number of holder holes 33 and holder holes 34 provided for accommodating the probes 2. Corresponding ones of the holder holes 33 and the holder holes 34 that accommodate one of the probes 2 are formed so as to have axes thereof in one line. Locations where the holder holes 33 and the holder holes 34 are formed are determined in accordance with the wiring pattern of the semiconductor integrated circuit 100.

[0021] Each of the holder holes 33 and each of the holder holes 34 both have stepped shapes differing in

diameters along the directions in which the holder hole 33 and the holder hole 34 penetrate. That is, the holder hole 33 is composed of a small-diameter portion 33a that has an opening on the upper end surface of the probe holder 3, and
5 a large-diameter portion 33b having a larger diameter than this small-diameter portion 33a. The small-diameter portion 33a has a diameter slightly larger than the diameter of the first plunger 21. The large-diameter portion 33b has a diameter slightly larger than the
10 diameter of the pipe member 23.

[0022] On the other hand, the holder hole 34 is composed of a small-diameter portion 34a that has an opening on the lower end surface of the probe holder 3, and a large-diameter portion 34b having a larger diameter than this
15 small-diameter portion 34a. The small-diameter portion 34a has a larger diameter than the second plunger 22. The large-diameter portion 34b has a diameter slightly larger than the diameter of the pipe member 23. The shapes of these holder holes 33 and 34 are determined in accordance
20 with the configuration of the probe 2 accommodated therein.

[0023] The pipe member 23 abuts a wall surface of the boundary between the small-diameter portion 33a and the large-diameter portion 33b of the holder hole 33, thereby having the function of preventing the probe 2 from coming
25 out of the probe holder 3. The pipe member 23 also abuts a wall surface of the boundary between the small-diameter portion 34a and the large-diameter portion 34b of the holder hole 34, thereby having the function of preventing the probe 2 from coming out of the probe holder 3. Any
30 length, such as a length shorter than the length of the large-diameter portion 33b and the large-diameter portion 34b combined while they are in communication with each other, that allows the first plunger 21 and the second

plunger 22 to individually project from the probe holder 3 is applicable as the longitudinal length of the pipe member 23.

[0024] FIG. 3 is a view illustrating a state of the semiconductor integrated circuit 100 when a test using the probe holder 3 is performed thereon. When a test is performed on the semiconductor integrated circuit 100, the spring member inside the pipe member 23 is in a compressed state in the longitudinal direction thereof by receiving a contact load from the semiconductor integrated circuit 100. The first plunger 21 enters the inside of the pipe member 23 when the spring member is thus compressed. Individual test signals supplied from the circuit substrate 200 to the semiconductor integrated circuit 100 during the test are delivered to the connecting electrodes 101 of the semiconductor integrated circuit 100 from electrodes 201 of the circuit substrate 200 via the probes 2. Specifically, a test signal is delivered to the corresponding connecting electrode 101 of the semiconductor integrated circuit 100 through the second plunger 22, the spring member inside the pipe member 23, and the first plunger 21 in the corresponding probe 2.

[0025] In addition, the distal end of the first plunger 21 is formed in tapered shapes. Therefore, when there is an oxide coating formed on the connecting electrode 101, the distal ends break through the oxide coating and can be brought into direct contact with the connecting electrode 101. The shapes of the distal ends of the first plunger 21 and the second plunger 22 can be changed as appropriate in accordance with the shapes of objects that they make contact with.

[0026] FIG. 4 is a perspective view illustrating the configuration of the main part of the socket attaching

structure according to the present embodiment. FIG. 5 is a perspective view illustrating the configuration of the holder member 4 in the socket attaching structure according to the present embodiment. The holder member 4 includes a main body part 40 formed of metal such as iron-based metal, brass, or stainless steel (SUS), or a material obtained by applying an insulating process to synthetic resin, ceramic, or the aforementioned metal. An impaction hole 411 into which the probe holder 3 can be impacted is provided in the main body part 40. The main body part 40 has cutout portions 41a and 41b provided on opposite sides having outer edges on an upper surface side of the main body part 40 and obtained by cutting out the holder member along these outer edges. The cutout portions 41a and 41b serve as a guide for a location where the leaf spring 5 is to be attached. The cutout portions 41a and 41b have: insertion holes 412a to 412d into which corresponding shafts 201a to 201d (supporting members; refer to FIG. 1 and 4) protruding from the circuit substrate 200 can be inserted; and screw holes 413a and 413b into which screws 401a and 401b to be used for attaching the leaf spring 5 on the main body part 40 are screwed.

[0027] The shafts 201a to 201d vertically extend from the main surface of the circuit substrate 200 while forming substantially cylindrical shapes. The respective shafts 201a to 201d have small-diameter portions 211a to 211d provided in the distal end sides thereof and having smaller diameters than the other portions thereof.

[0028] FIG. 6 is a perspective view illustrating the configuration of the leaf spring 5 in the socket attaching structure according to the present embodiment. FIG. 7 is a plan view illustrating the configuration of the main part of the leaf spring 5 illustrated in FIG. 6. The leaf

spring 5 is formed of a metal material having spring characteristics, for example, stainless steel such as SUS 301. The leaf spring 5 has a base portion 50 formed in a substantially belt-like shape and arm portions 51a and 51b
5 extending, in a direction substantially perpendicular to the longitudinal direction of the base portion 50 on a plane that a plate surface passes through, from the longitudinally opposite ends of the base portion 50 while forming belt-like shapes. In a plan view from a direction
10 perpendicular to a plate surface of the base portion 50, the leaf spring 5 forms a substantially C-like shape.

[0029] The arm portion 51a has a first extending portion 511a extending from one end portion of the base portion 50 and a second extending portion 512a extending from the
15 distal end of the first extending portion 511a while forming an arch shape. In the arm portion 51a, the first extending portion 511a is located on a plane passing through a plate surface of the base portion 50, and the second extending portion 512a forms a shape raised and bent
20 in a direction that draws the second extending portion 512a more apart from the plane.

[0030] The arm portion 51b has a first extending portion 511b extending from the other end portion of the base portion 50 and a second extending portion 512b extending
25 from the distal end of the first extending portion 511b while forming an arch shape. In the arm portion 51b, the first extending portion 511b is located on a plane passing through a plate surface of the base portion 50, and the second extending portion 512b forms a shape raised and bent
30 in a direction that draws the second extending portion 512b more apart from the plane.

[0031] The arm portions 51a and 51b have through-holes (first through-holes) 52a to 52d formed in correspondence

with the insertion holes 412a to 412d and through-holes 53a and 53b (second through-holes) in accordance with the screw holes 413a and 413b. The through-holes 52a to 52d penetrate the arm portions 51a and 51b in a direction of the plate thickness thereof. The through-holes 53a and 53b penetrate the arm portions 51a and 51b in a direction of the plate thickness thereof. Here, the through-holes 52a and 52b are provided in the second extending portions 512a and 512b, respectively. The through-holes 52c and 52d are provided in the first extending portions 511a and 511b of the arm portions 51a and 51b, respectively. The through-hole 53a is provided between the through-hole 52a and the through-hole 52c. The through-hole 53b is provided between the through-hole 52b and the through-hole 52d.

[0032] The through-hole 52a has a first hole portion 521 having a diameter larger than the largest diameter (the largest diameter in a portion that is inserted) of the shaft 201a, and a second hole portion 522 extending from one end of the first hole portion 521 toward one side different from a distal end side (toward the first extending portion 511a) and having a width smaller than the diameter of the opening of the first hole portion 521. The second hole portion 522 has a catch portion 525 (fixing portion) that seizes the small-diameter portion 211a of the shaft 201a. The catch portion 525 is formed by a slit 523 extending from a lateral part of the second hole portion 522 and another slit 524 longitudinally extending from the distal end of the second hole portion 522, and forms a part of a side wall of the second hole portion 522. The second hole portion 522 extends in a uniform width that is substantially equal to the diameter of the small-diameter portion 211a. The slit 523 forms an L-like shape first extending in the width direction of the second hole portion

522, then making a turn, and then extending in the longitudinal direction of the arm portion 51a.

[0033] The through-hole 52a has a retaining portion 522a formed by a first end portion of the second hole portion 522 and a catch portion 525 (a protruding portion 525a). The first end portion is opposite to an end portion of the second hole portion 522 at which it communicates with the first hole portion 521. The retaining portion 522a is capable of having the small-diameter portion 211a inserted therethrough and retaining it. A circle that touches the periphery of the retaining portion 522a is substantially equal to a circle formed by the outer circumference of the small-diameter portion 211a. That is, when entering a state inserted through the retaining portion 522a, the small-diameter portion 211a is seized by the protruding portion 525a and enters in a state fixed to the through-hole 52a.

[0034] The catch portion 525 is capable of moving in spaces formed by the slits 523 and 524 on a plane parallel to the main surface. In the distal end portion of the catch portion 525, the protruding portion 525a protruding toward the second hole portion 522 (in the width direction) is provided. When there is no load acting on the catch portion 525, a width W1 (the smallest width) formed by the distal end of the protruding portion 525a and a wall surface of the second hole portion 522 that faces the protruding portion 525a is smaller than the width W2 of the second hole portion 522. In the present embodiment, the aforementioned through-hole 52b has the same structure.

[0035] The through-hole 52c has a first hole portion 526 having a diameter larger than the largest diameter (the largest diameter in a portion that is inserted) of the shaft 201a, and a second hole portion 527 extending from

one end of the first hole portion 526 in a direction not toward a distal end and having a width smaller than the diameter of the opening of the first hole portion 526. The second hole portion 527 extends in a uniform width that is substantially equal to the diameter of the small-diameter portion 211c. The through-hole 52d has the same structure.

5 [0036] The through-holes 53a and 53b extend in a direction parallel to the direction in which the aforementioned second hole portion 522 extends. Lengths in which the through-holes 10 53a and 53b extend in the aforementioned direction are longer than the lengths of the through-holes 52a to 52d each measured from one end to the other end of a corresponding one of the through-holes 52a to 52d in the longitudinal directions of the arm portions 51a and 51b.

15 [0037] In the first extending portion 511a, a bent portion 511c is provided that is obtained by bending an edge portion of one side of the first extending portion 511a that is opposite to the side thereof that faces the first extending portion 511b. The bent portion 511c is obtained by bending 20 the first extending portion 511a so that the bent portion 511c can be raised and bent toward the same direction as the second extending portion 512a is raised and bent. The corresponding bent portion 511d is provided also in the first extending portion 511b.

25 [0038] In the bent portion 511c, one end portion thereof that faces the second extending portion 512a is provided at a position located between the through-hole 52c and the through-hole 53a and predetermined distances apart from these respective through-holes. In the bent portion 511d, an end 30 portion thereof that faces the second extending portion 512b is provided at a position located between the through-hole 52d and the through-hole 53b and predetermined

distances apart from these respective through-holes.

[0039] Here, the diameters of the insertion holes 412a to 412d and of the first hole portion 521 are larger than the largest diameters of the shafts 201a to 201d. In addition, the width of the second hole portion 522 is larger than the small-diameter portions 211a to 211d and smaller than the largest diameters of the shafts 201a to 201d. The shafts 201a to 201d are provided so as to be attachable to and detachable from the circuit substrate 200 by being screwed into and out of the insertion holes 412a to 412d.

[0040] Furthermore, the leaf spring 5 is attached to the holder member 4 with the arm portions 51a and 51b disposed on the upper surfaces of the cutout portions 41a and 41b. The leaf spring 5 are fixed with the screws 401a and 401b inserted through the through-holes 53a and 53b so as to be prevented from separating from the holder member 4. The screws 401a and 401b are attached to the circuit substrate 200 by being screwed into the screw holes 413a and 413b after being inserted through the through-holes 53a and 53b, respectively (refer to FIG. 4).

[0041] Next, with reference to FIGS. 8 to 13, a procedure for mounting the holder member 4 on the circuit substrate 200 is described. FIGS. 8, 10, and 12 are perspective views illustrating the configuration of the main part of the socket attaching structure according to the present embodiment, and are views illustrating a procedure for mounting the holder member 4 on the circuit substrate 200. FIGS. 9, 11, and 13 are local sectional views illustrating the configuration of the main part of the socket attaching structure according to the present embodiment, and are views illustrating the procedure for mounting the holder member 4 on the circuit substrate 200.

[0042] In the first place, the holder member 4 is attached to the circuit substrate 200 with the arm portions 51a and 51b of the leaf spring 5 placed on the cutout portions 41a and 41b and with the insertion holes 412a and 412b of the holder member 4 being in communication with the first hole portions 521 of the through-holes 52a and 52b, respectively. At this point, the shafts 201a to 201d are inserted through the insertion holes 412a to 412d, respectively, and through the through-holes 52a and 52b (refer to FIG. 8). At this point, for example, the small-diameter portion 211a of the shaft 201a is in the first hole portion 521 of the through-hole 52a (refer to FIG. 9). In the leaf spring 5, the second extending portions 512a and 512b are in contact with the cutout portions 41a and 41b, the portions other than the second extending portion 512a and 512b are apart from the upper surface of the main body part 40 and is sloping.

[0043] Subsequently, the second extending portions 512a and 512b are slid along the cutout portions 41a and 41b, and a load is then applied to the base portion 50 of the leaf spring 5 such that the base portion 50 draws closer to the main body part 40, so that the first extending portions 511a and 511b are brought into close proximity of or contact with the main body part 40 (refer to FIG. 10). Here, in the state illustrated in FIG. 8, in the arm portions 51a and 51b, front end portions of the second extending portions 512a and 512b have been fixed because the shafts 201a and 201b have been inserted through the through-holes 52a and 52b. When the base portion 50 is brought closer to the main body part 40 from this state, for example, the first extending portion 511a of the arm portion 51a comes into close proximity of the holder member 4. Because of a load generated by a resiling action of the

arm portion 51b toward its initial curved state, the second
extending portion 512b (a bent portion) enters a state
pressed against the holder member 4. In this manner, a
state in which the leaf spring 5 presses the holder member
5 4 toward the circuit substrate 200 is brought about.

[0044] When the base portion 50 is brought into close
proximity to the main body part 40, the shafts 201c and
201d are inserted through the through-holes 52c and 52d,
respectively. At this point, for example, the small-
10 diameter portion 211c of the shaft 201c is in the first
hole portion 526 of the through-hole 52c.

[0045] Furthermore, when the arm portions 51a and 51b
are slid, for example, the small-diameter portion 211a that
have been in the first hole portion 521 moves to the second
15 hole portion 522. At this point, the small-diameter
portion 211a abuts the protruding portion 525a of the catch
portion 525, and then moves the catch portion 525 toward
the slit 523, thereby enlarging the width of the second
hole portion 522 (refer to FIG. 11). The small-diameter
20 portion 211c moves to the second hole portion 527 also in
the through-hole 52c.

[0046] When the arm portions 51a and 51b are further
slid, the shafts 201a to 201d abut end portions (end
portions of the second hole portions) of the through-holes
25 52a to 52d (refer to FIG. 12). At this point, as
illustrated in FIG. 13, the small-diameter portion 211a is
accommodated in the retaining portion 522a. In this manner,
the small-diameter portion 211a is prevented from moving
toward the first hole portion 521, and the leaf spring 5
30 can be fixed. In this state, the leaf spring 5 fixes the
holder member 4 by pressing it toward the circuit substrate
200, so that the holder member 4 is fixed to the circuit
substrate 200.

[0047] With the configuration and behavior as described above, sliding the leaf spring 5 with a load applied thereto is sufficient for fixing the leaf spring 5 to the circuit substrate 200 and thereby attaching the holder member 4 to the circuit substrate 200. In addition, after having been fixed on the holder member 4 with the shafts 201a to 201d, the leaf spring 5 can make the holder member 4 tightly attached to the circuit substrate 200 because the holder member 4 presses the circuit substrate 200 with loads due to the flexion of the arm portions 51a and 51b.

[0048] In detachment of the holder member 4 from the circuit substrate 200, sliding the leaf spring 5 in a direction opposite to the direction in which it is slid in the attachment is sufficient for the detachment.

[0049] Furthermore, the bent portion 511c is bent from the first extending portion 511a toward the same direction as the second extending portion 512a forms an arch shape, that is, the bent portion 511c is bent in a direction opposite to a direction in which a load acts on the leaf spring 5 in attaching the holder member 4 to the circuit substrate 200. The strength of the arm portion 51a against the load can be thus reinforced. In this manner, the durability of the leaf spring 5 in repetitive use can be improved.

[0050] In the bent portion 511c, an end portion thereof that faces the second extending portion 512a is provided at a position located between the through-hole 52c and the through-hole 53a and predetermined distances apart from these respective through-holes. In this case, the strength of the arm portion 51a can be higher than in a case where the end portion is provided near the through-hole 52c or the through-hole 53a. In this manner, the durability of the leaf spring 5 in repetitive use can be improved.

[0051] The same effects as those described above for the bent portion 511c can be also obtained for the bent portion 511d.

[0052] According to the aforementioned embodiment,
5 attachment of the holder member 4 to the circuit substrate 200 can be implemented only by applying a load to the leaf spring 5 attached to the holder member 4 and sliding the leaf spring 5 to make the leaf spring 5 retained by the shafts. Easy attachment and detachment of the holder
10 member 4 to and from the circuit substrate 200 are thus enabled.

[0053] According to the aforementioned embodiment, the bent portions 511c and 511d, when the leaf spring 5 is attached to the holder member 4, are set in a state bent in
15 a direction away from the holder member 4. The attachment is thus enabled regardless of the size of the holder member 4. In addition, as compared with a case where the bent portions 511c and 511d are not provided, the workability when a user grips the leaf spring 5 (the arm portions 51a
20 and 51b) can be improved with the bent portions 511c and 511d provided.

[0054] In fixing a holder member and a circuit substrate to each other by screwing as in conventional cases, it is necessary to take the torque of screws into account. In
25 contrast, the socket attaching structure according to the present embodiment makes it unnecessary to use screws in fixing the holder member 4 and the circuit substrate 200, thus enabling the fixation without the need of taking the torque of screws into account.

30 [0055] In the aforementioned embodiment, the shafts 201a to 201d can be secured to conventional screw holes intended for use in attachment by screwing, and therefore can be implemented without dedicated holes provided in the

substrate.

[0056] In the aforementioned embodiment, although the descriptions assume that the small-diameter portions 211a to 211d are provided in the shaft 201a to 201d, each of the shafts may form a shape having only the distal end thereof enlarged to have a diameter larger than the width of the second hole portion 522.

[0057] In the aforementioned embodiment, although the descriptions assume that the catch portions 525 are provided in the through-holes 52a and 52b, catch portions may be provided alternatively in the through-holes 52c and 52d and may be otherwise provided in all of the through-holes 52a to 52d or in any desired one or more through-holes.

[0058] In the aforementioned embodiment, although the descriptions assume that the fixing portion is the catch portion 525 formed by the slits 523 and 524 and having the protruding portion 525a, the fixing portion may simply be a catch (corresponding to the protruding portion 525a) protruding from a side wall of the second hole portion 522 as long as the catch can retain and fix the small-diameter portion 211a as a result of movement of the leaf spring 5.

[0059] In the aforementioned embodiment, although the descriptions assume that the leaf spring 5 is previously attached to the holder member 4 with the screws 401a and 401b, the leaf spring 5 may be configured not to be attached thereto in advance. It may be after the holder member 4 is arranged on the circuit substrate 200 that the leaf spring 5 is attached on the holder member 4 and screwed with the screws 401a and 401b.

[0060] In the aforementioned embodiment, although the descriptions assume that the connecting electrode 101 forms a semispherical shape, the connecting electrode 101 may be

a flat plate-like lead for use in a quad flat package (QFP) or the like.

[0061] The probe 2 is not limited to a probe composed of plungers and a pipe member as illustrated in FIG. 2, and
5 may be a probe not including a pipe member (a probe composed of plungers and a coil spring) or a wire probe that generates a load when a wire is warped into an arch.

[0062] In the aforementioned embodiment, although the descriptions assume that the probe holder and the holder
10 member are separate members, the probe holder and the holder member may be integrally formed as a single member, or may be implemented only with the probe holder provided as a single member that includes the aforementioned configuration of the holder member.

15 Industrial Applicability

[0063] As described above, the socket attaching structure and the spring member according to the present invention serve for easy attachment and detachment of a socket to and from a circuit substrate.

20 Reference Signs List

[0064] 1 SOCKET
2 CONTACT PROBE (PROBE)
3 PROBE HOLDER
4 HOLDER MEMBER
25 5 LEAF SPRING
21 FIRST PLUNGER
22 SECOND PLUNGER
23 PIPE MEMBER
31 FIRST MEMBER
30 32 SECOND MEMBER
33, 34 HOLDER HOLE
33a, 34a, 211a to 211d SMALL-DIAMETER PORTION
33b, 34b LARGE-DIAMETER PORTION

	40	MAIN BODY PART
	41a, 41b	CUTOUT PORTION
	50	BASE PORTION
	51a, 51b	ARM PORTION
5	52a to 52d, 53a, 53b	THROUGH-HOLE
	100	SEMICONDUCTOR INTEGRATED CIRCUIT
	101	CONNECTING ELECTRODE
	200	CIRCUIT SUBSTRATE
	201	ELECTRODE
10	201a to 201d	SHAFT
	401a, 401b	SCREW
	411	IMPACTION HOLE
	412a to 412d	INSERTION HOLE
	413a, 413b	SCREW HOLE
15	511a, 511b	FIRST EXTENDING PORTION
	512a, 512b	SECOND EXTENDING PORTION
	521, 526	FIRST HOLE PORTION
	522, 527	SECOND HOLE PORTION
	523, 524	SLIT
20	525	CATCH PORTION

CLAIMS

1. A socket attaching structure for attaching a socket including a plurality of contact probes, a probe holder, and a holder member to a substrate, the contact probes each
5 being configured to make contact with the substrate and a contact receiving body on respective longitudinally opposite ends of the contact probe, the probe holder being configured to accommodate and retain the contact probes in accordance with a predetermined pattern, the holder member
10 being disposed around the probe holder, the socket attaching structure comprising:

a plurality of supporting members extending from a main surface of the substrate and configured to be individually inserted through insertion holes provided in
15 the holder member; and

a plate-like spring member configured to be attached to the supporting members while biasing the holder member toward the substrate with the holder member placed on the substrate, wherein

20 the spring member includes

first through-holes penetrating the spring member in a plate thickness direction thereof and capable of having the corresponding supporting members inserted therethrough, and

25 a fixing portion forming a part of a side wall of at least one of the first through-holes and configured to retain and fix a corresponding one of the supporting members.

30 2. The socket attaching structure according to claim 1, wherein

the spring member includes

a base portion forming a substantially belt-like

shape, and

two arm portions extending, on a plane that a plate surface passes through, through from longitudinally opposite ends of the base portion in a direction

5 substantially perpendicular to the longitudinal direction of the base portion, the arm portions each having a middle portion thereof curved in an arch,

the spring member forms a substantially C-like shape in a plan view from a direction perpendicular to the plate
10 surface of the base portion, and

the first through-holes are provided to the respective arm portions.

3. The socket attaching structure according to claim 2,
15 wherein

each of the supporting members is a columnar shape and includes, at a distal end thereof, a small-diameter portion having a diameter smaller than a diameter of other portions,

each of the first through-hole includes

20 a first hole portion having a diameter larger than a largest diameter of the supporting members, and

a second hole portion extending in a uniform width from an end portion of the first hole portion toward one side of each of the arm portions that is different from a
25 distal end of the arm portion, the small-diameter portion being insertable into the second hole portion, and

the fixing portion is a catch portion formed by slits extending from a side wall of the second hole portion, the catch portion being configured to seize the supporting
30 member.

4. The socket attaching structure according to claim 2 or

3, wherein each of the two arm portions is provided with a bent portion formed by bending an edge portion thereof on one side opposite to another side that faces the other one of the arm portions.

5

5. The socket attaching structure according to any one of claims 2 to 4, wherein

the holder member has screw holes into which screws are capable of being screwed,

10 each of the arm portions has a second through-hole penetrating the arm portion in a plate thickness direction thereof in accordance with a corresponding one of the screw holes, and

the holder member and the spring member are joined
15 together with the screws inserted into the second through-holes and screwed into the screw holes.

6. The socket attaching structure according to any one of claims 1 to 5, wherein the holder member includes two
20 cutout portions provided on opposite sides having outer edges on an upper surface side of the holder member and obtained by cutting out the holder member along the outer edges, the cutout portions being configured to serve as a guide for a location on the holder member where the spring
25 member is to be attached.

7. A spring member for use in attaching a socket including a plurality of contact probes, a probe holder, and a holder member to a substrate, the contact probes each
30 being configured to make contact with the substrate and a contact receiving body on respective longitudinally opposite ends of the contact probe, the probe holder being configured to accommodate and retain the contact probes in

accordance with a predetermined pattern, the holder member being disposed around the probe holder, the spring member comprising:

- 5 first through-holes formed therein penetrating the spring member in a plate thickness direction thereof and configured to have a plurality of supporting members individually inserted therethrough while keeping the holder member placed on the substrate in a state receiving a load that biases the holder member toward the substrate, the
- 10 supporting members extending from a main surface of the substrate and being configured to be individually inserted through insertion holes provided in the holder member; and
- a fixing portion forming a part of a side wall of at least one of the first through-holes and configured to
- 15 retain and fix a corresponding one of the supporting members.