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Socket for electronic component including locating spring

Abstract

A socket includes a housing with a bottom plate portion and a frame body portion standing at edges of the bottom plate portion and extending along the edges. The frame body portion serves as a locator in an in-plane direction of the bottom plate portion in mounting an electronic component. The bottom plate portion and the frame body portion are integrally molded into the housing. The socket includes a plurality of contacts supported by the bottom plate portion. The socket includes a spring member including a supported portion supported by a first side of the frame body portion and a spring portion that elastically deforms by being pushed by the electronic component, pressing the electronic component against a second side opposite to the first side.

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References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
6164980	12/1999	Goodwin	N/A	N/A
6905377	12/2004	Murr	N/A	N/A
7785112	12/2009	Hashimoto	439/66	H01R 12/7076
2009/0042412	12/2008	Hashimoto et al.	N/A	N/A
2009/0286417	12/2008	Taguchi	439/331	H05K 7/1007
2010/0261372	12/2009	Chang	N/A	N/A
2011/0195589	12/2010	Takahashi	N/A	N/A
2021/0126394	12/2020	Hashimoto	N/A	H05K 3/3457
2021/0257765	12/2020	Yamada	N/A	H01R 13/03

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
1505210	12/2003	CN	N/A
H11317272	12/1998	JP	N/A
2005174901	12/2004	JP	N/A
2007103311	12/2006	JP	N/A
2011165512	12/2010	JP	N/A
2021072175	12/2020	JP	N/A

OTHER PUBLICATIONS

Japanese Office Action dated Apr. 18, 2025 with English translation, corresponding to Application No. 2021-151103, 11 pages. cited by applicant

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

(1) This application claims the benefit of the filing date under 35 U.S.C. § 119(a)-(d) of Japanese

Patent Application No. 2021-151103, filed on Sep. 16, 2021.

FIELD OF THE INVENTION

(2) The present invention relates to a socket into which an electronic component having a two-dimensional array of contact pads on a bottom surface thereof is fitted.

BACKGROUND

(3) When a circuit board is mounted with a large-scale electronic component, the electronic component is usually mounted via a socket instead of being directly soldered to the circuit board. That is, the electronic component is usually fitted into the socket after the socket has been positioned on top of the circuit board. The socket includes a large number of contacts, arrayed in such a manner as to project from a first surface of a flat-plate housing, that make contact separately with each of contact pads arrayed on a bottom surface of the electronic component.

(4) Japanese Patent Application No. 2021-072175A discloses a socket including a flat-plate housing having a large number of contacts arrayed and a frame body, attached to the housing, that extends along edges of the housing and locates a mounted electronic component by touching side surfaces of the electronic component. This socket of JP 2021-072175A increases the positional accuracy of mounting of the mounted electronic component by positioning a spring member on one side of the frame body and pressing the electronic component against a side opposite to the side on which the spring member is positioned.

(5) The socket of JP 2021-072175A has a structure in which the frame body is attached to the flat-plate housing. This makes it necessary to account for a tolerance of attachment of the frame body to the housing, and to the extent of such a tolerance, a decrease in positional accuracy of mounting of the electronic component is inevitable.

(6) Further, this socket of JP 2021-072175A cannot press the electronic component directly against the first surface of the housing and makes it necessary to position a seat member on top of the housing and mount the electronic component while keeping it appropriately away from the housing. This causes a decrease in positional accuracy of the electronic component in a height direction to the extent of a tolerance of height of the seat member.

(7) Furthermore, this socket of JP 2021-072175A makes it necessary to array solder balls on a second surface of the housing, thus making it impossible to bring the circuit board, to which the socket is to be soldered, into close contact with the second surface of the housing and making it necessary to position a standoff member on the second surface of the housing to keep an appropriate distance between the second surface of the housing and the circuit board.

(8) Thus, this socket of JP 2021-072175A is structured to have many types of components and be assembled through a large number of steps.

SUMMARY

(9) A socket includes a housing with a bottom plate portion and a frame body portion standing at edges of the bottom plate portion and extending along the edges. The frame body portion serves as a locator in an in-plane direction of the bottom plate portion in mounting an electronic component. The bottom plate portion and the frame body portion are integrally molded into the housing. The socket includes a plurality of contacts supported by the bottom plate portion. The socket includes a spring member including a supported portion supported by a first side of the frame body portion and a spring portion that elastically deforms by being pushed by the electronic component, pressing the electronic component against a second side opposite to the first side.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The invention will now be described by way of example with reference to the accompanying Figures, of which:

(2) FIG. **1**A is an isometric view of a socket according to a first embodiment;
(3) FIG. **1**B is an enlarged view of a portion in a circle R**1** of FIG. **1**A;
(4) FIG. **2**A is an exploded isometric view of the socket of FIG. **1**A;
(5) FIG. **2**B is an enlarged view of a portion in a circle R**2** of FIG. **2**A;
(6) FIG. **3**A is a top view of the socket of FIG. **1**A;
(7) FIG. **3**B is an enlarged view of a portion in a circle R**3** in FIG. **3**A;
(8) FIG. **4**A is a top view of an electronic component mounted in the socket of FIG. **1**A;
(9) FIG. **4**B is an enlarged view of a portion in a circle R**4** in FIG. **4**A;
(10) FIG. **5**A is an enlarged view of a portion of the socket of FIG. **1**A;
(11) FIG. **5**B is a sectional side view of the portion of the socket of FIG. **5**A, taken along line X-X;
(12) FIG. **6**A is a top view of a bottom plate portion of a housing of the socket;
(13) FIG. **6**B is an isometric view of the bottom plate portion of FIG. **6**A;
(14) FIG. **7**A is a front view of a part of the bottom plate portion of the housing of the socket of FIG. **6**A;
(15) FIG. **7**B is a side view of the bottom plate portion of the housing;
(16) FIG. **7**C is a sectional front view of the bottom plate portion of the housing, taken along line Y-Y of FIG. **6**A;
(17) FIG. **8**A is an enlarged isometric view of a part of a socket according to a second embodiment;
(18) FIG. **8**B is a sectional side view of the socket of FIG. **8**A, taken along line Z-Z;
(19) FIG. **9**A is an isometric view of a spring member according to a third embodiment;
(20) FIG. **9**B is an exploded isometric view of the spring member of FIG. **9**A;
(21) FIG. **10**A is an isometric view of a spring member according to a fourth embodiment; and
(22) FIG. **10**B is an exploded isometric view of the spring member of FIG. **10**A.

DETAILED DESCRIPTION OF THE EMBODIMENTS

(23) Embodiments of the invention will be described below. Various elements in the drawings are merely schematically and illustratively shown for understanding of the present disclosure and may differ in outward appearance and/or dimensional ratio from actual ones. Furthermore, the following description uses, on an as-needed basis, terms that indicate particular directions or positions. However, the use of these terms is intended to facilitate understanding of the invention with reference to the drawings, and the meanings of these terms are not intended to limit the technical scope of the present disclosure. Further, components given identical reference signs throughout a plurality of drawings refer to identical or equivalent components.
(24) A socket **10** according to an embodiment, shown in FIGS. **1**A-**2**B, includes a housing **20** and a spring member **30**. The housing **20** includes a bottom plate portion **21** and a frame body portion **22**, and is a molded article into which the bottom plate portion **21** and the frame body portion **22** are integrally molded, for example from an identical material or an identical blend of components. Note, however, that the bottom plate portion **21** and the frame body portion **22** may be molded articles molded in two colors from different materials or different blends of components.
(25) The bottom plate portion **21** has a first surface **211** and a second surface **212** (see FIGS. **7**A-C) that spread parallel to each other. Of these surfaces, only the first surface **211** appears in FIGS. **1**A-**2**B. The second surface **212** is the opposite side to the first surface **211**. The bottom plate portion **21** has an array of a plurality of, e.g. as many as 10,000, contact support holes **213** (see FIGS. **7**A-C), and in each of at least any plurality of contact support holes **213**, contacts **40** are plugged one by one. FIGS. **1**A-**2**B omit the illustration contact support holes or contacts of the housing **20**.
(26) The frame body portion **22** stands at edges of the first surface **211** of the bottom plate portion **211** and extends substantially all around along the edges. Note, however, that for convenience of removal of a mounted electronic component **50** (see FIGS. **4**A and **4**B), notched portions **221** in which the frame body portion **22** is not present are formed in two places, one on the right side and the other on the left side, respectively.
(27) The frame body portion **22** acts together with the spring member **30**, which will be described

below, as a locator in mounting the electronic component **50** in an in-plane direction of the first surface **211**. Further, the frame body portion **22** has protruding portions **228**, formed on at least one side, in an embodiment two or more sides **223** and **225**, of the frame body portion **22**, that project inward. The formation of these protruding portions **228** allows the electronic component **50** to be mounted only when the electronic component **50** is in a correct orientation (see FIGS. **4**A and **4**B).

(28) On at least any of the left and upper sides **222** and **223** of FIGS. **1**A-**2**B of the four sides of the frame body portion **22**, at least one, and in an embodiment two, spring members **30** is positioned on each of the sides (**222** and **223**). On those sides **222** and **223**, slit-like supporting portions **226** for supporting the spring members **30** are formed separately in correspondence with each of the spring members **30**.

(29) Further, the sides (**224** and **225**) of the four sides of the frame body portion **22** opposite to the sides (**222** and **223**) on which the spring members **30** are positioned, receiving portions **227** bulging inward are formed in positions separately facing each of the spring members **30**. These receiving portions **227** are abutted by the mounted electronic component **50** being pushed by the spring members **30**.

(30) Each of the spring members **30** has a shape extending from side to side as a whole, and includes supported portions **31**, provided on both the right and left sides, that are supported by being inserted into the slit-like supporting portions **226** of the frame body portion **22** and a spring portion **32**, provided in the center, that projects toward the opposite side (**224** or **225**). Further, each of the spring members **30** further includes an inviting portion **33**, shown in FIG. **2**B, obliquely rising onto the side (**222** or **223**) of the frame body portion **22** on which the spring member **30** is supported and an extension portion **34** that extends toward the outside of the frame body portion **22**. Correspondingly, the frame body portion **22** has a mounting portion **230** having an inclined surface **231** and an upward surface **232**. The inviting portion **33** invites the mounted electronic component **50** into the frame body portion **22**, thereby making it easy to mount the electronic component **50**.

(31) As shown in FIG. **4**A, the electronic component **50** has long grooves **51** formed in positions corresponding to the protruding portions **228** of the frame body portion **22**. When the electronic component **50** is mounted into the socket **10**, the electronic component **50** is mounted in such an orientation that the protruding portions **228** of the frame body portion **22** fit into the long grooves **51** of the electronic component **50**, so that the electronic component **50** is not mounted in a wrong orientation other than that orientation.

(32) Further, a comparison between FIG. **3**B and FIG. **4**B shows that once the electronic component **50** is mounted, the spring portions **33** of the spring members **30** elastically deform by being pushed toward the sides of the frame body portion **22** on which the spring members **30** are supported. The electronic component **50** is pressed against the receiving portions **227** by being pushed toward the opposite sides by a reaction force. This causes the electronic component **50** to be located with high accuracy in the in-plane direction of the first surface **211**.

(33) Note here that the sides (**222** and **223**) of the frame body portion **22** on which the spring members **30** are supported are equivalent to what is called “first side” according to the invention, and the sides (**224** and **225**) opposite to those sides (**222** and **223**) on which the receiving portions **227** are formed are equivalent to what is called “second side” according to the invention.

(34) FIG. **5**B shows a cross-section of a spring member **30**, shown in a perspective view in FIG. **5**A. FIG. **5**B also shows contacts **40** projecting upward and downward from the bottom surface portion **21** of the housing **20**. Once mounted, the electronic component **50** makes direct contact with the first surface **211** of the bottom plate portion **21**. On the other hand, the spring member **30** is positioned in a slightly higher position than the first surface **211** without touching the first surface **211**. FIG. **5** is referred to in describing a second embodiment (see FIGS. **8**A and **8**B).

(35) FIG. **7**A is a front view of part of the bottom plate portion of the housing shown in FIG. **6**, a side view is shown in FIG. **7**B, and a cross sectional view is shown in FIG. **7**C taken along line Y-Y

shown in FIG. **6**A. FIG. **7**C clarifies a positional relationship with the bottom plate portion **21** of the housing **20** by showing a lower surface of the electronic component **50** with the electronic component **50** mounted in the socket **10** and an upper surface of a circuit board **60** with the socket **10** mounted on the circuit board **60**.

(36) The bottom plate portion **21** of the housing **20** has, for example, ten thousand contact support holes **213** formed therein, and into each of the contact support holes **213**, the contacts **40** are plugged one by one to be supported by walls of the contact support holes **213**.

(37) Each of the contacts **40**, as shown in FIG. **7**C, includes a plugged portion **41** plugged into a corresponding one of the contact support holes **213**, a first contact portion **42** projecting toward the first surface **211** of the bottom plate portion **21**, and a second contact portion **43** projecting toward the second surface **212** of the bottom plate portion **21**. The plugged portion **41** is a portion that is plugged into the contact support hole **213** and supported by the bottom plate portion **21**. The first contact portion **42** serves as an electrical contact with the electronic component **50** mounted in the socket **10**. Further, the second contact portion **43** serves as an electrical contact with the circuit board **60** on which the socket **10** is mounted.

(38) Once mounted in the socket **10**, a bottom surface of the electronic component **50** makes direct contact with the first surface **211** of the bottom plate portion **21**. For this reason, the bottom plate portion **211** has a first depressed portion **214** formed in a position on the first surface **211** adjacent to a corresponding one of the contact support holes **213**, as shown in FIG. **7**C. Once the electronic component **50** is mounted in the socket **10**, the first contact portion **42** is accommodated in the first depressed portion **214** after having elastically deformed by being pushed by the electronic component **50** thus mounted. This makes it unnecessary to keep the electronic component **50** at a certain distance from the bottom plate portion **21** by positioning a seat member or other members on top of the bottom plate portion **21**, so that the electronic component **50** is located with high accuracy accordingly in an up-and-down direction.

(39) Further, similarly, once the socket **10** is placed on top of the circuit board **60**, the second surface **212** of the bottom plate portion **21** makes direct contact with the circuit board **60**. For this reason, the bottom plate portion **21** has a second depression portion **215** formed in a position adjacent to the contact support hole **213**, as shown in FIG. **7**C. Once the socket **10** is placed on top of the circuit board **60**, the second contact portion **42** is accommodated in the second depressed portion **215** after having elastically deformed by being pushed by the circuit board **60**.

(40) This is the end of the foregoing description of the first embodiment, and the following describes the second embodiment and subsequent embodiments. It should be noted that the second embodiment and subsequent embodiments are illustrated and described in terms of differences from the first embodiment. Note, however, that the second embodiment and subsequent embodiments are given the same signs as those used in the description of the first embodiment.

(41) In the case of the first embodiment, as shown in FIG. **5**B, the spring member **30** is positioned in a slightly higher position than the first surface **211** of the bottom plate portion **21** without touching the first surface **211**. On the other hand, in the case of the second embodiment, a recessed portion **216** is formed in a place in the first surface **211** of the bottom plate portion **21** in which the spring member **30** is positioned, as shown in FIGS. **8**A and **8**B. The spring member **30** is supported by the frame body portion **22** while being partially stuck in the recessed portion **216**. Moreover, a height h**2** from the first surface **211** of the frame body portion **22** is lower than a height h**1** of the frame body portion **22** of the first embodiment shown in FIG. **5**. Note, however, that a width w of the spring portion **32** is equal to a width w of the spring portion **32** of the first embodiment.

(42) As a socket **10** into which an electronic component **50** that is small in thickness in a height direction is mounted, a socket **10** whose frame body portion **22** is low in height h**2** is employed. In this case, employing a spring member **30** that is narrow in width w may weaken a spring force. Accordingly, in the second embodiment, a recessed portion **216** is formed so that part of a spring member **30** is positioned in such a position as to be stuck in the recessed portion **216**. This makes it

possible to, while ensuring a sufficient spring force by using a spring member **30** that is identical to that of the first embodiment, achieve a socket **10** whose frame body portion **22** is low in height.
(43) FIG. **9**A shows a state where the spring member **30** is supported by the housing **20** and FIG. **9**B is an exploded view of FIG. **9**A. Each of the spring members **30** according to the first and second embodiment hitherto described is a spring member having the shape of a double-fixed beam having supported portions **31** provided on both the right and left sides. On the other hand, the spring member **30** of a third embodiment in FIGS. **9**A and **9**B is a spring member having the shape of a cantilever having a supported portion **31** provided either of the right and left sides. For example, as shown in FIGS. **9**A and **9**B, a supported portion **31** is provided on the left side and extends obliquely inward toward the right side, and a spring portion **32** is provided at a free end situated away from the side of the frame body portion **22** on which the spring member **30** is supported. Moreover, an inviting portion **33** formed obliquely upward is provided on top of the spring portion **32**.
(44) Further, in the third embodiment of FIGS. **9**A and **9**B, the frame body portion **22** has a slit **233** formed therein, and the bottom plate portion **21** has support holes **217** formed in places adjacent to the frame body portion **22**. Correspondingly, the supported portion **31** of the spring member **30** is provided with a folded portion **311** and projecting portions **312**. The spring member **30** is supported by the folded portion **311** being inserted into the slit **233** and the projecting portions **312** being inserted into the support holes **217**. Further, the frame body portion **22** has a notched portion **234** formed therein so as not to prevent the spring member **30** from elastically deforming when an electronic component is mounted into the socket **10**.
(45) FIGS. **10**A and **10**B show a spring member according to a fourth embodiment; FIG. **10**A shows a state where the spring member **30** is supported by the housing **20**. The spring member **30** of the fourth embodiment has a supported portion **31**, provided on the left side of FIG. **10**, that extends rightward along the side of the frame body portion **22** on which the spring member **30** is supported and, furthermore, has its right free end folded inward so that a spring portion **32** is provided. Moreover, an inviting portion **33** formed obliquely upward is provided on top of the spring portion **32**. A supporting structure of the spring member **30** of the fourth embodiment is identical to that of the third embodiment, and a description of the supporting structure is omitted.
(46) As in the cases of the third embodiment shown in FIGS. **9**A and **9**B and the fourth embodiment shown in FIGS. **10**A and **10**B, the spring member **30** may have the shape of a cantilever.
(47) The foregoing socket according to the invention makes it possible to reduce the number of types of components and improve the positional accuracy of mounting of an electronic component.

Claims

1. A socket, comprising: a housing including a bottom plate portion having a first surface and a second surface that are parallel to each other and an array of a plurality of contact support holes bored through the first surface and the second surface, and a frame body portion standing at edges of the first surface and extending along the edges, the frame body portion serving as a locator in an in-plane direction of the first surface in mounting an electronic component having a plurality of contact pads formed on a lower surface of the electronic component, the bottom plate portion and the frame body portion are integrally molded into the housing; a plurality of contacts supported by the bottom plate portion while being plugged in the contact support holes, each of the contacts including: a plugged portion plugged in one of the contact support holes; a first contact portion having a free end projecting and positioned beyond the first surface and adapted to contact the electronic component; and a second contact portion having a free end projecting and positioned beyond the second surface and adapted to contact a circuit board; and a spring member including a supported portion supported by a first side of the frame body portion and a spring portion that

elastically deforms by being pushed by the electronic component and presses the electronic component against a second side opposite to the first side.
2. The socket of claim 1, wherein the housing has a recessed portion in the first surface of the bottom plate portion in which the spring member is positioned.
3. The socket of claim 2, wherein the spring member is supported by the frame body portion while being positioned in the recessed portion.
4. The socket of claim 1, wherein the bottom plate portion has a first depressed portion adjacent of each of the contact support holes, formed in the first surface to a depth less than a thickness of the bottom plate portion in a direction of the second surface, in which the free end of the first contact portion is accommodated after being elastically deformed by the electronic component.
5. The socket of claim 4, wherein the bottom plate portion has a second depressed portion adjacent of each of the contact support holes, formed in the second surface to a depth less than a thickness of the bottom plate portion in a direction of the first surface, in which the free end of the second contact portion is accommodated after being elastically deformed by the circuit board.
6. The socket of claim 1, wherein the spring member extends from a right side to a left side and has the supported portion on each of the right side and the left side.
7. The socket of claim 6, wherein the spring member has the spring portion in a central position between the left side and the right side.
8. The socket of claim 7, wherein the spring portion projects further toward the second side than the supported portion.
9. The socket of claim 8, wherein the frame body portion supports the supported portion.
10. The socket of claim 1, wherein the spring member extends in a horizontal direction in a shape of a cantilever.
11. The socket of claim 10, wherein the spring member has the spring portion at a free end of the cantilever.
12. A socket, comprising: a housing including a bottom plate portion and a frame body portion extending from a plurality of edges of the bottom plate portion; and a spring member including: a supported portion supported by a first side of the frame body portion; and a spring portion extending toward a second side of the frame body portion opposite to the first side, the supported portion including a first supported portion extending obliquely from the first side of the frame body portion in a direction toward the second side of the frame body portion, and a second supported portion extending obliquely from the first side of the frame body portion in a direction toward the second side of the frame body portion, the spring portion supported on each of a first side and a second side thereof by a respective one of the first and second supported portions.
13. The socket of claim 12, wherein the frame body portion and the spring member are a locator in an in-plane direction of the bottom plate portion in mounting an electronic component in the socket.
14. The socket of claim 13, wherein the spring portion elastically deforms by being pushed by the electronic component and presses the electronic component against the second side of the frame body portion.
15. The socket of claim 13, further comprising a plurality of contacts supported by the bottom plate portion, the contacts contact a plurality of contact pads formed on a lower surface of the electronic component.
16. The socket of claim 12, wherein the bottom plate portion and the frame body portion are integrally formed.
17. The socket of claim 12, wherein the spring member has the spring portion in a central position between the first and second supported portions.
18. The socket of claim 12, wherein the spring portion projects further toward the second side than the supported portion such that the spring portion is elastically deformable in a direction toward the first side of the frame body portion against an elastic return force of the supported portion.

19. The socket of claim 12, wherein each of the first supported portion and the second supported portion are removably attached to the first side of the frame body.
20. The socket of claim 19, wherein the frame body defines supporting portions receiving free ends of the first supported portion and the second supported portion for fixing the free ends of the first and second supported portions to the frame body.