US 20160227648A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2016/0227648 A1

(43) Pub. Date: Aug. 4, 2016

SAWADA et al.

(54) **PRINTED WIRING BOARD CAPABLE OF SUPPRESSING MOUNTING FAILURE OF SURFACE MOUNT DEVICE FOR FLOW SOLDERING**

(71) Applicant: **FANUC Corporation**, Yamanashi (JP)

(72) Inventors: **Takeshi SAWADA**, Yamanashi (JP); **Yuichi OKOUCHI**, Yamanashi (JP); **Daisuke MIURA**, Yamanashi (JP)

(21) Appl. No.: **15/013,286**

(22) Filed: **Feb. 2, 2016**

(30) **Foreign Application Priority Data**

Feb. 3, 2015 (JP) 2015-19698

Publication Classification

(51) **Int. Cl.**

H05K 1/11 (2006.01)
H05K 1/02 (2006.01)
H05K 1/18 (2006.01)

(52) **U.S. Cl.**

CPC ***H05K 1/112*** (2013.01); ***H05K 1/181*** (2013.01); ***H05K 1/0271*** (2013.01)

(57) **ABSTRACT**

The width of a lead-terminal connection pad on a printed wiring board is not greater than the width of a lead terminal. Therefore, a wider space can be secured between adjacent solder joints, so that bridge failure can be suppressed. Further, the length of projection of the lead-terminal connection pad at the proximal portion of the lead terminal is shorter than that of a lead-terminal connection pad on a conventional printed wiring board. Thus, a solder pool at the proximal portion of the lead terminal can be reduced to suppress bridge defect.

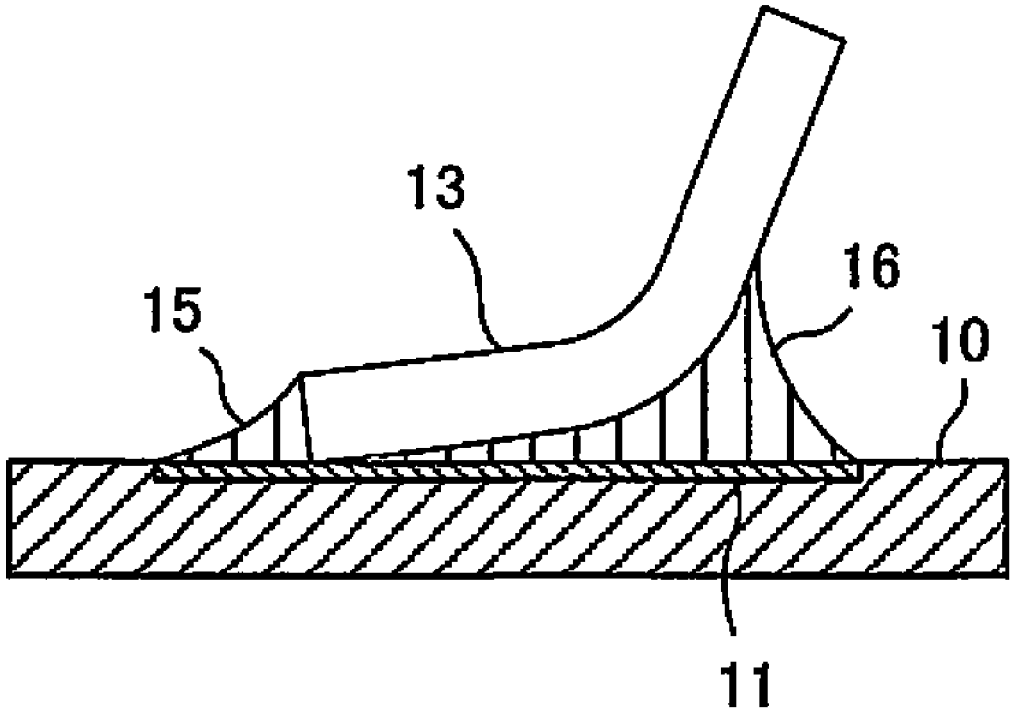


FIG. 1A

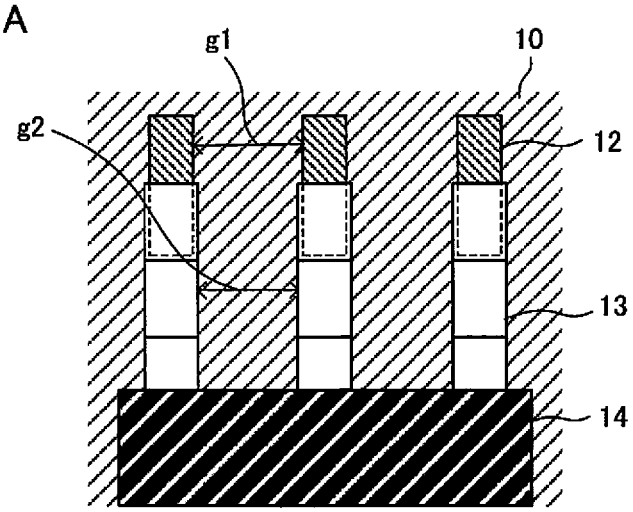


FIG. 1B

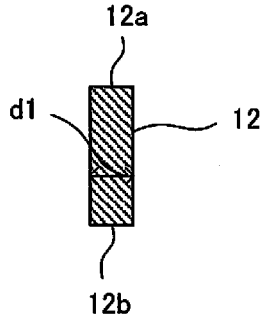


FIG. 1C

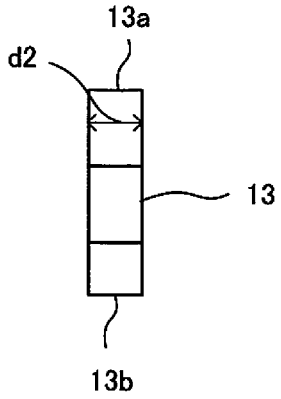


FIG. 2

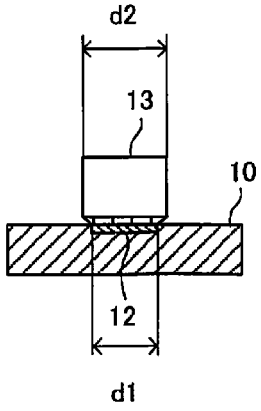


FIG. 3

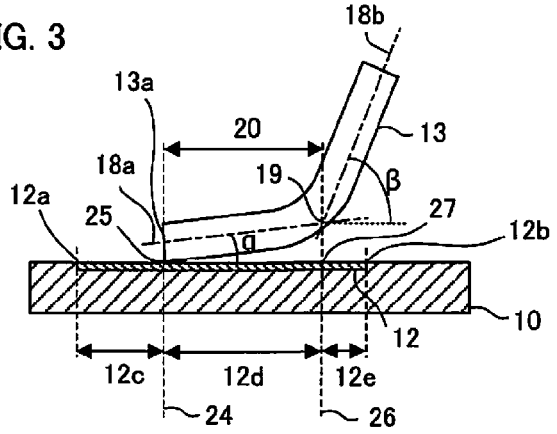


FIG. 4

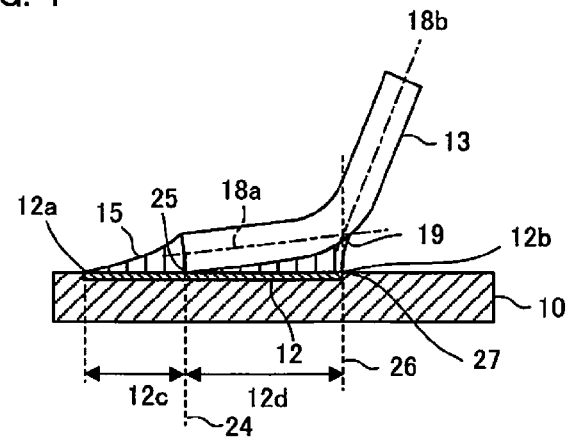


FIG. 5

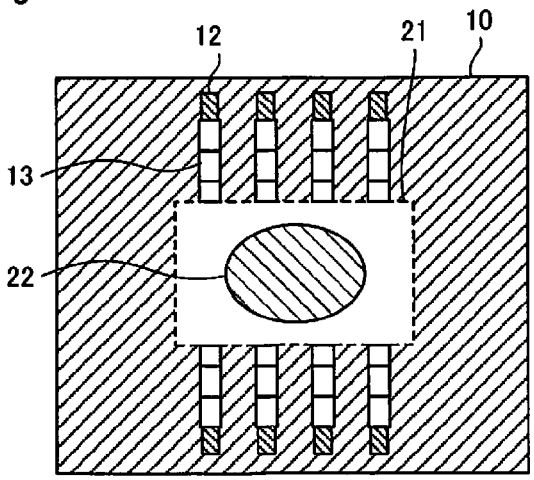


FIG. 6

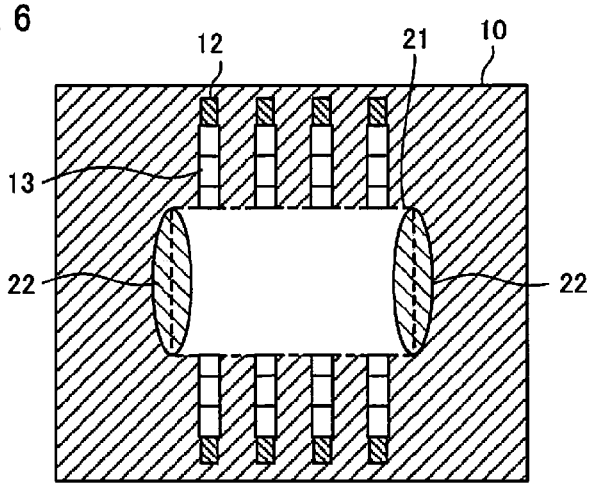


FIG. 7

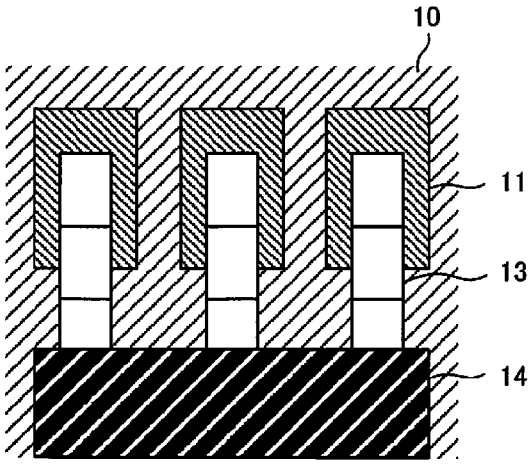


FIG. 8

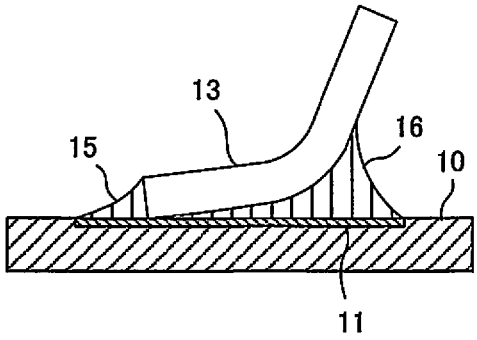
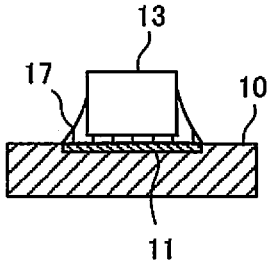


FIG. 9



PRINTED WIRING BOARD CAPABLE OF SUPPRESSING MOUNTING FAILURE OF SURFACE MOUNT DEVICE FOR FLOW SOLDERING

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a printed wiring board capable of suppressing mounting failure, such as a short circuit, by means of adjacent lead terminals or lead-terminal connection pads of a surface mount device in a flow soldering step.

[0003] 2. Description of the Related Art

[0004] FIGS. **7** to **9** show an example of the configuration of a conventional printed wiring board. FIG. **7** illustrates a surface mount device **14** mounted on a printed wiring board **10**, lead terminals **13**, and lead-terminal connection pads **11**. FIG. **7** shows a part of a package body of the surface mount device **14**. FIG. **8** is a sectional view of one of the lead terminals **13** of FIG. **7** taken in its extending direction. A top fillet **15** is formed on a front pad projection portion of the lead. A large back fillet **16** is formed on the rear portion of the lead. Further, FIG. **9** is a sectional view of one of the lead terminals **13** of FIG. **7** taken in a direction perpendicular to the extending direction. The lead-terminal connection pad **11** is made wider than the lead terminal **13** to form a side fillet **17**.

[0005] A process for mounting the surface mount device **14** on the printed wiring board **10** roughly comprises steps of reflow soldering and flow soldering. In the reflow soldering, the amount of solder can be adjusted by adjusting the supply of a solder paste. In the flow soldering, in contrast, the printed wiring board **10** is soldered by being brought into contact with jet solder in a molten solder bath, so that it is difficult to accurately adjust the solder supply to the surface mount device **14**. Therefore, the process for mounting the surface mount device **14** on the printed wiring board **10** by the flow soldering has a problem that a short circuit is caused between the adjoining lead terminal **13** and lead-terminal connection pad by the surface tension of the solder.

[0006] Conventionally, therefore, there are techniques in which a solder-free partition plate is formed in a gap in each lead-terminal connection pad **11** of the surface mount device **14** so as to suppress bridge failure between each lead terminal **13** and the pad **11** (Japanese Patent Applications Laid-Open Nos. 9-219487 and 5-259624).

[0007] Further, there are techniques in which bridge failure at the proximal portion of the lead terminal is suppressed by tapering the lead-terminal connection pad **11** for soldering the lead terminal **13** of the surface mount device **14** toward the proximal portion of the lead terminal (or toward the package of the surface mount device **14**) so that the pad **11** is as wide as the lead terminal **13** (Japanese Patent Applications Laid-Open Nos. 2001-339146 and 3-229486).

SUMMARY OF THE INVENTION

[0008] The techniques disclosed in Patent Document 1 (Japanese Patent Application Laid-Open No. 9-219487) and Patent Document 2 (Japanese Patent Application Laid-Open No. 5-259624) are disadvantageous in that the use of the partition plate results in an increase in cost and the need of additional processes. In the techniques disclosed in Patent Document 3 (Japanese Patent Application Laid-Open No. 2001-339146) and Patent Document 4 (Japanese Patent Application Laid-Open No. 3-229486), bridge failure is suppressed by inhibiting the concentration of molten solder on curved portions by a capillary phenomenon in the reflow soldering step. In the flow soldering step, however, soldering is performed by bringing the printed wiring board into contact with the jet solder. The wider each lead-terminal connection pad, therefore, the shorter the spaces between the connection pads corresponding to the distal end portions of the lead terminals are. Thus, there is a possibility of the occurrence of bridge failure, so that a satisfactory effect cannot be expected.

[0009] Accordingly, in view of the above-described problems of the prior art, the object of the present invention is to provide a printed wiring board capable of suppressing mounting failure of a surface mount device in a flow soldering step.

[0010] A printed wiring board according to the present invention, on which a surface mount device with a plurality of lead terminals is mounted by flow soldering, comprises a plurality of lead-terminal connection pads for mounting the surface mount device, the distance between each two adjacent ones of the lead terminals being not greater than the distance between each two adjacent ones of the lead-terminal connection pads.

[0011] Each of the lead-terminal connection pads is formed of a front pad projection portion located in front of the lead, a pad center portion located below the lead, and a rear pad projection portion located at the back of the lead, the front pad projection portion being longer than the rear pad projection portion.

[0012] Each of the lead-terminal connection pads is formed of a front pad projection portion located in front of the lead and a pad center portion located below the lead.

[0013] The printed wiring board and the reverse side of a package of the surface mount device are bonded together by adhesive means.

[0014] The printed wiring board and bottom surface ends and side surfaces of a package of a contour portion without a lead terminal in the surface mount device are bonded together by adhesive means.

[0015] According to the present invention, there can be provided a printed wiring board capable of suppressing mounting failure of a surface mount device in a flow soldering step.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The above and other objects and features of the present invention will be obvious from the ensuing description of embodiments with reference to the accompanying drawings, in which:

[0017] FIGS. **1**A, **1**B and **1**C are views showing Embodiment 1 according to the present invention;

[0018] FIG. **2** is a view illustrating Embodiment 1 according to the present invention;

[0019] FIG. **3** is a view showing Embodiment 2 according to the present invention;

[0020] FIG. **4** is a view showing Embodiment 3 according to the present invention;

[0021] FIG. **5** is a view showing Embodiment 4 according to the present invention;

[0022] FIG. **6** is a view showing Embodiment 5 according to the present invention;

[0023] FIG. **7** is a view showing a conventional printed wiring board;

[0024] FIG. **8** is a sectional view of a lead terminal of a mounted component mounted on the conventional printed wiring board; and

[0025] FIG. **9** is a sectional view of the lead terminal of the mounted component mounted on the conventional printed wiring board.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] Embodiments of the present invention will now be described with reference to the accompanying drawings.

Embodiment 1

[0027] FIGS. **1**A, **1**B and **1**C are schematic views showing a configuration of the present embodiment. FIG. **2** is a front view of a lead terminal briefly showing the present embodiment. A surface mount device **14** is mounted on a printed wiring board **10** in a flow soldering step. The printed wiring board **10** is provided with lead-terminal connection pads **12** for soldering lead terminals **13** of the surface mount device **14**.

[0028] Each of the lead-terminal connection pads **12**, which is provided on the printed wiring board **10** so as to be electrically connected to a circuit pattern (not shown), has a rectangular shape with a width kept constant from an outer end portion **12***a* to an inner end portion **12***b*. The direction from the outer end portion **12***a* toward the inner end portion **12***b* is the direction in which the package of the surface mount device **14** is approached as the surface mount device **14** is mounted on the printed wiring board **10**. The width of each lead-terminal connection pad **12** is denoted by d**1**. The surface mount device **14** is provided with the lead terminals **13** and the width (denoted by d**2**) of each lead terminal **13** is kept constant from a distal end portion **13***a* to a proximal portion **13***b*. The proximal portion **13***b* is a part of the lead terminal **13** projecting outward from the package of the surface mount device **14**. The width of that part of the lead terminal **13** which is connected to the lead-terminal connection pad **12** by soldering is at least equal to the width d**2**.

[0029] The width dl of the lead-terminal connection pad **12** is not larger than the width d**2** of the lead terminal **13** (d**1**≤d**2**). In order to suppress mounting failure in the flow soldering step, a gap in the lead-terminal connection pad or the lead terminal can be maximized by making the width of the lead-terminal connection pad not larger than that of the lead terminal.

[0030] In other words, there is a relation g**1**≥g**2**, where g**1** is the distance between each two adjacent lead-terminal connection pads **12** of the printed wiring board **10** and g**2** is the distance between each two adjacent lead terminals **13** of the surface mount device **14**. Thus, the width of a gap between adjoining solder joints (respective joints of the lead-terminal connection pad **12** and the lead terminal **13**) can be increased to suppress bridge failure.

Embodiment 2

[0031] FIG. **3** is a sectional view of a lead terminal briefly showing a lead length according to the present embodiment. In general, when a surface mount device **14** is mounted on a printed wiring board **10**, a lead terminal **13** rises at an angle α from its distal end portion **13***a*, further rises at an angle β (α<β) from a lead curve portion **19**, and then reaches a package of the surface mount device **14**. The angles α and β are based on a surface of a lead-terminal connection pad **12** as a reference surface.

[0032] The point of intersection of a thickness center line **18***a* of a front portion of the lead terminal **13**, ranging from the distal end portion **13***a* to the lead curve portion **19**, and a thickness center line **18***b* of a rear portion behind the lead curve portion **19** corresponds to the lead curve portion **19**. Numeral **25** denotes the point of intersection of the lead-terminal connection pad **12** and a perpendicular line **24** drawn down from the distal end portion **13***a* to the lead-terminal connection pad **12**.

[0033] Further, numeral **27** denotes the point of intersection of the lead-terminal connection pad **12** and a perpendicular line **26** drawn down from the lead curve portion **19** to the lead-terminal connection pad **12**.

[0034] The lead-terminal connection pad **12** can be divided between a front pad projection portion **12***c*, pad center portion **12***d*, and rear pad projection portion **12***e*. The front pad projection portion **12***c* is located in front of the lead and covers a section from the outer end portion **12***a* to the intersection point **25**. The pad center portion **12***d* is located below the lead and covers a section from the intersection point **25** to the intersection point **27**. The rear pad projection portion **12***e* is located at the back of the lead and covers a section from the intersection point **27** to the inner end portion **12***b*. The length of the pad center portion **12***d* below the lead is called a lead length **20**. The length of projection of the lead-terminal connection pad **12** from the distal end portion **13***a* (or the length of the front pad projection portion **12***c* in front of the lead) is characterized in being longer than the length of the rear pad projection portion **12***e* at the back of the lead.

[0035] Further, the length of projection of the lead-terminal connection pad **12** at the proximal portion of the lead terminal (or the length of the rear pad projection portion **12***e* at the back of the lead) is shorter than that of the lead-terminal connection pad **11** (see FIGS. **7** to **9**) on the conventional printed wiring board. Thus, in the printed wiring board **10** of Embodiment **1**, a solder pool at the proximal portion of the lead terminal can be reduced to suppress bridge failure.

Embodiment 3

[0036] The present embodiment shown in FIG. **4** is characterized in that the length of a projection portion **12***e* of a lead-terminal connection pad **12** from an end of its portion at the back of a lead terminal is 0 and that an inner end portion **12***b* of a lead-terminal connection pad **12** is coincident with a point **27** of intersection of the lead-terminal connection pad **12** and a perpendicular line **26** drawn down from the lead curve portion **19** of FIG. **3** to the lead-terminal connection pad **12**. Specifically, the lead-terminal connection pad **12** is formed of a front pad projection portion **12***c*, which is located in front of the lead and covers a section from an outer end portion **12***a* to an intersection point **25**, and a pad center portion **12***d*, which is located below the lead and covers a section from the intersection point **25** to the intersection point **27**. Thus, in a printed wiring board **10** of Embodiment 3, a solder pool at the proximal portion of the lead terminal can be reduced to suppress bridge failure.

Embodiment 4

[0037] FIG. **5** is a general top view briefly showing the present embodiment. FIG. **5** shows how an adhesive is

applied between a printed wiring board **10** and the bottom surface of a package of a surface mount device **14** for flow soldering. This configuration is characterized in that good mechanical strength can be achieved even in case the amount of solder used for soldering is small. A double-sided tape may be used in place of the adhesive. A member such as the adhesive or the double-sided tape used to bond two members is called an adhesive member.

Embodiment 5

[0038] FIG. **6** is a general top view briefly showing the present embodiment. In FIG. **6**, the entire body of surface mount device **21** is illustrated. An adhesive is applied between a printed wiring board and the bottom surface ends and side surfaces of a package of a contour portion (adhesive application area **22**) without a lead terminal in a surface mount device for flow soldering. Thus, good mechanical strength can be achieved even in case the amount of solder used for soldering is small.

1. A printed wiring board on which a surface mount device with a plurality of lead terminals is mounted by flow soldering, the printed wiring board comprising:

a plurality of lead-terminal connection pads for mounting the surface mount device,

wherein the distance between each two adjacent ones of the lead terminals is not greater than the distance between each two adjacent ones of the lead-terminal connection pads.

2. The printed wiring board according to claim **1**, wherein each of the lead-terminal connection pads is formed of a front pad projection portion located in front of the lead, a pad center portion located below the lead, and a rear pad projection portion located at the back of the lead, the front pad projection portion being longer than the rear pad projection portion.

3. The printed wiring board according to claim **1**, wherein each of the lead-terminal connection pads is formed of a front pad projection portion located in front of the lead and a pad center portion located below the lead.

4. The printed wiring board according to claim **1**, wherein the printed wiring board and the reverse side of a package of the surface mount device are bonded together by adhesive means.

5. The printed wiring board according to claim **1**, wherein the printed wiring board and bottom surface ends and side surfaces of a package of a contour portion without a lead terminal in the surface mount device are bonded together by adhesive means.

* * * * *