

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN OR RELATING TO TERMINALS

(71) We, E. I. DU PONT DE NEMOURS AND COMPANY, a corporation organized and existing under the laws of the State of Delaware, United States of America, of Wilmington, State of Delaware, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a terminal for soldering to a conductive pad, for example, to a solder substrate clip for engagement with a conductive pad on an edge of a substrate.

Solder terminals and solder substrate clips are described in United States Patent Specifications Nos. 3,351,704; 3,750,265; 3,750,252; 3,889,364; and 3,953,102. In the solder terminals and substrate clips described in the above Patent Specifications the mass of solder is secured to an arm of the clip to the side away from the contact surface. The mass does not extend across an edge of the arm. Heating and melting of the mass of molten solder must establish a flow path across a sheared rough edge of the clip to reach a conductive pad on an edge of the substrate. The molten solder does not reliably flow across the edge of the contact arm resulting in an unsatisfactory soldered connection between the contact arm and the conductive pad along the edge of the substrate.

According to the present invention there is provided a terminal for soldering to a conductive pad comprising a contact arm having a contact surface on one side thereof, a solder mounting surface on the other side thereof and an edge extending between said surfaces, a mass of solder on the mounting surface extending beyond said edge, and a solder globule projecting from the solder mass along said edge towards the contact surface.

In one embodiment of the invention, the terminal comprises a substrate clip having a contact arm stamped from sheet metal stock.

The edge extending between said contact and solder mounting surfaces is sheared and solder free. The mass of solder is metallurgically bonded to the solder mounting surface and extends beyond the sheared edge. The solder globule projects from the mass of solder along the unplated edge of the arm towards the contact surface of the arm.

The terminal is preferably in the form of a substrate clip having a second contact arm spaced from the first contact arm, the second contact arm having a contact surface facing the contact surface of the first contact arm. The substrate clip preferably has three contact arms and a tail extending away from the clip. The first arm is preferably centrally disposed with the other two arms sheared and spaced from the first arm for receiving an edge of a substrate prior to soldering one or more of the arms to a conductive pad along an edge of the substrate.

The mass of solder may be provided on either the solder mounting surface of the central arm or the solder mounting surfaces of the two spaced arms. If required, a mass of solder may be provided on the solder mounting surfaces of each of the central arm and the two spaced arms. A solder globule projects from the or each mass of solder along the edge of the respective contact arm towards the contact surface of that contact arm.

Embodiments of the present invention will hereinafter be described, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 is a side view of an embodiment of a terminal of the invention in the form of a solder substrate clip,

Figure 2 is a sectional view taken along line 2—2 of Figure 1,

Figure 3 is a perspective view of the clip shown in Figures 1 and 2 mounted on a support with one edge of a ceramic substrate positioned between the arms of the clip prior to soldering.

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Figure 4 is a sectional view taken along line 4-4 of Figure 3, and

Figure 5 is a view similar to Figure 4 after soldering.

A solder substrate clip 10 is preferably stamped from relatively thin solder-coated sheet metal stock. The clip at one end includes three substrate engaging arms 14, 16 and 18. The first arm 16 is centrally disposed and each of the other arms 14 and 18 is sheared and spaced from the first arm 16 to provide a substrate or support-receiving opening 20 for receiving an edge of the substrate previous to soldering. A tail or mounting portion 12 at the other end of the substrate clip 10 extends away from the three substrate engaging arms 14, 16 and 18. Each arm includes a contact surface 22 on a crest facing the substrate-receiving opening 20 and a solder mounting surface 24 extending along a valley on the side of the arm away from the contact surface. The valleys and crests are formed by bends at the ends of the arms. Sheared edges 26 on the sides of the arms extend between the contact surface 22 and the solder mounting surface 24. The sheet metal stock from which the substrate clip is formed is preferably pre-plated or coated with a layer of solder. The sheared edges 26 of each arm are free of any solder coating or plating. The valleys and crests in their respective contact and solder mounting surfaces 22, 24 extend between the edges 26 on opposite sides of each arm.

As illustrated in Figure 1, a discrete solder mass 30 is bonded to the solder mounting surface 24 of the centrally disposed arm 16, and a solder mass 28 is bonded to the solder mounting surfaces 24 of the spaced arms 14 and 18. Each solder mass 28, 30 includes a solder globule 32 adherent to each edge 26 of the arms adjacent the contact surface 22 of each arm 14, 16 and 18.

The solder globules 32 provide a significant technical advantage in soldering the clip to a conductive pad 46 on a substrate 44. By adhering to the unplated edges 26 of the contact arms, the globule extends a distance along the edges between the solder masses 28, 30 and the contact surfaces 22. During soldering, the clip and conductive pad 44 along an edge of the substrate are heated to a temperature sufficient to melt the solder masses 28, 30 and globules 32 assures that the molten solder flows from the side of the contact arm away from the conductive pads 46, over the unplated edge 26 of the arm to the conductive pad 46. The solder globules 32 increase the reliability of the resultant solder connection over those obtained through the use of conventional solder terminals where a mass of solder is attached to the side of a contact

member or arm away from the surface to be soldered to a conductive pad or contact without a solder globule along an unplated edge of such an arm.

The solder substrate clip illustrated includes discrete solder masses 28, 30 bonded to each of the central arm 16 and the pair of spaced arms 14, 18, and the illustrated clip can thus be soldered to a conductive pad 46 on each surface of a substrate. However, generally, such clips are soldered to a conductive pad on one surface of a substrate and one of the solder masses 28 or 30 may be omitted. Whether the solder mass is provided on the central arm 16 or the spaced arms 14, 18 is generally determined by the width of the conductive pad to which the clip is to be soldered.

The solder masses 28, 30 may be bonded to the solder mounting surface 26 on arm 16 or arms 14 and 18 by positioning a round solder wire against the mounting surface and heating the arm or arms and solder wire, e.g., using an electrical current, sufficiently to flow the solder at the interface of the arm or arms, bond the solder wire metallurgically to the mounting surface 24 and form the solder globules 32 along the unplated edges 26 of the arm 16 or arms 14, 18.

The invention is described above with reference to a solder substrate clip having three contact arms. However the invention is not limited to such clips and extends to terminals having one or more contact arms. Furthermore, the solder mass need not be cylindrical as illustrated but can be of any required configuration. In addition, the tail or mounting portion of the terminal can be of any configuration required.

WHAT WE CLAIM IS:—

1. A terminal for soldering to a conductive pad comprising a contact arm having a contact surface on one side thereof, a solder mounting surface on the other side thereof, and an edge extending between said surfaces, a mass of solder on the mounting surface extending beyond said edge, and a solder globule projecting from the solder mass along said edge towards the contact surface.
2. A terminal as claimed in claim 1, wherein said solder mass is metallurgically bonded to the solder mounting surface.
3. A terminal claimed in claim 1 or 2 wherein the arm has a second edge extending between said surfaces and the solder mass extends beyond the second edge, and comprising a second solder globule projecting from the solder mass along the second edge towards the contact surface.
4. A terminal as claimed in any preceding claim, wherein the contact surface is on a crest on the arm, and the solder mounting

Figure 4 is a sectional view taken along line 4—4 of Figure 3, and

Figure 5 is a view similar to Figure 4 after soldering.

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As illustrated in Figure 1, a discrete solder mass 30 is bonded to the solder mounting surface 24 of the centrally disposed arm 16, and a solder mass 28 is bonded to the solder mounting surfaces 24 of the spaced arms 14 and 18. Each solder mass 28, 30 includes a solder globule 32 adherent to each edge 26 of the arms adjacent the contact surface 22 of each arm 14, 16 and 18.

The solder globules 32 provide a significant technical advantage in soldering the clip to a conductive pad 46 on a substrate 44. By adhering to the unplated edges 26 of the contact arms, the globule extends a distance along the edges between the solder masses 28, 30 and the contact surfaces 22. During soldering, the clip and conductive pad 44 along an edge of the substrate are heated to a temperature sufficient to melt the solder masses 28, 30 and globules 32 assures that the molten solder flows from the side of the contact arm away from the conductive pads 46, over the unplated edge 26 of the arm to the conductive pad 46. The solder globules 32 increase the reliability of the resultant solder connection over those obtained through the use of conventional solder terminals where a mass of solder is attached to the side of a contact

member or arm away from the surface to be soldered to a conductive pad or contact without a solder globule along an unplated edge of such an arm.

The solder substrate clip illustrated includes discrete solder masses 28, 30 bonded to each of the central arm 16 and the pair of spaced arms 14, 18, and the illustrated clip can thus be soldered to a conductive pad 46 on each surface of a substrate. However, generally, such clips are soldered to a conductive pad on one surface of a substrate and one of the solder masses 28 or 30 may be omitted. Whether the solder mass is provided on the central arm 16 or the spaced arms 14, 18 is generally determined by the width of the conductive pad to which the clip is to be soldered.

The solder masses 28, 30 may be bonded to the solder mounting surface 26 on arm 16 or arms 14 and 18 by positioning a round solder wire against the mounting surface and heating the arm or arms and solder wire, e.g., using an electrical current, sufficiently to flow the solder at the interface of the arm or arms, bond the solder wire metallurgically to the mounting surface 24 and form the solder globules 32 along the unplated edges 26 of the arm 16 or arms 14, 18.

The invention is described above with reference to a solder substrate clip having three contact arms. However the invention is not limited to such clips and extends to terminals having one or more contact arms. Furthermore, the solder mass need not be cylindrical as illustrated but can be of any required configuration. In addition, the tail or mounting portion of the terminal can be of any configuration required.

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1. A terminal for soldering to a conductive pad comprising a contact arm having a contact surface on one side thereof, a solder mounting surface on the other side thereof and an edge extending between said surfaces, a mass of solder on the mounting surface extending beyond said edge, and a solder globule projecting from the solder mass along said edge towards the contact surface.

2. A terminal as claimed in claim 1, wherein said solder mass is metallurgically bonded to the solder mounting surface.

3. A terminal claimed in claim 1 or 2 wherein the arm has a second edge extending between said surfaces and the solder mass extends beyond the second edge, and comprising a second solder globule projecting from the solder mass along the second edge towards the contact surface.

4. A terminal as claimed in any preceding claim, wherein the contact surface is on a crest on the arm, and the solder mounting





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surface extends along a valley on the arm opposite the crest.

5. A terminal as claimed in any preceding claim, wherein the or each edge extending between said surfaces is sheared.

6. A terminal as claimed in any preceding claim, in the form of a substrate clip having a second contact arm spaced from said first-mentioned contact arm, said second contact arm having a contact surface facing the contact surface of said first-mentioned contact arm.

7. A terminal as claimed in claim 6, wherein the second contact arm comprises a solder mounting surface on the other side thereof to said contact surface and at least one sheared edge extending between its contact and solder mounting surface, a second mass of solder metallurgically bonded to the solder mounting surface of the second arm and extending beyond the sheared edge of the second arm, and a solder globule projecting from the second solder mass along the sheared edge of the second arm towards the contact surface.

8. A terminal as claimed in claim 7, further comprising a third contact arm located adjacent said second contact arm, said third contact arm having a contact surface on one side thereof, a solder mounting surface on the other side thereof and at least one sheared edge extending between its con-

tact and solder mounting surfaces, wherein said second mass of solder is also metallurgically bonded to the solder mounting surface of said third contact arm, and a further solder globule projecting from the second solder mass along the sheared edge of the third arm towards the contact surface of the third arm.

9. A terminal as claimed in claim 8, wherein the sheared edges of said second and third contact arms are adjacent to one another, and wherein the contact surface of said third arm faces the contact surface of said first-mentioned contact arm.

10. A terminal as claimed in claim 8 or 9, further comprising a mounting portion extending away from said contact arms.

11. A terminal for soldering to a conductive pad substantially as herein before described with reference to and as illustrated in the accompanying drawings.

12. A substrate having at least one conductive pad along an edge thereof and having a terminal as claimed in any preceding claim soldered to said pad.

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