

CONTACT WITH ANTI-SKIVING FEATURE**Cross-Reference to Related Applications**

This application claims the benefit of U.S. Provisional Patent Application number 60/071,985 filed on January 21, 1998, herein
5 incorporated by reference.

Background of the Invention**1. Field of the Invention**

The present invention relates to a contact with an anti-skiving feature. More specifically, the present invention relates to a contact capable of
10 insertion within a connector housing without substantial skiving of the connector housing.

2. Brief Description of Earlier Developments

When separating contacts from a carrier strip, a cutting tool typically creates a severed edge with a burred region. When the cut-off travels
15 through the connector housing during insertion, the burr skives a layer of material from the retention portion of the connector housing. The skiving of the connector housing may reduce the amount of retention force imparted by the connector housing to retain the contact.

In addition, the portion of the housing skived by the burr may remain
20 on the contact after passing through the connector housing. To remove the skived portion from the contact, the connector assembly process requires an additional step. The connector assembly could use, for example, a brushing step to remove the skived portion from the contact prior to securing a fusible element to the contact. The additional step
25 increases manufacturing costs. Without removal, the skived portion may interfere with the proper attachment of the fusible element to the contact. Thus, the presence of the skived portion is unacceptable, especially in

automated applications. Clearly, there is room for improvement in the art.

Summary of the Invention

It is an object of the present invention to provide a contact that is insertable in a connector housing without skiving the housing.

5 It is a further object of the present invention to provide a contact that does not retain a skived portion of a connector housing thereon as it is inserted into the housing.

It is a further object of the present invention to provide a contact upon which a fusible element can be attached after the contact has been
10 inserted into a connector housing without the need for a cleaning step.

It is a further object of the present invention to provide a connector that can be assembled in fewer steps.

These and other objects of the present invention are achieved in one aspect of the present invention by a contact. The contact is insertable
15 into an insulative housing of a connector and has a mating end for receiving a mating contact; a retention portion for insertion into the connector; and a mounting end opposite the mating end. The mounting end has a transition area adapted to pass through the insulative housing without substantially skiving the insulative housing.

20 These and other objects of the present invention are achieved in another aspect of the present invention by a carrier strip. The carrier strip includes: a sheet of material having an edge; and at least one contact. The contact has a mounting end extending from said edge and including a window; a retention portion extending from the mounting end;
25 and a mating end extending from the retention portion.

These and other objects of the present invention are achieved in another aspect of the present invention by a connector. The connector

has an insulative housing with at least one aperture therethrough; and a contact insertable within said aperture. The contact has a mating end for receiving a mating contact; a retention portion for engaging the connector; and a mounting end opposite the mating end and having a die controlled region adjacent the retention portion. The die controlled region can pass through the insulative housing of the connector without substantially skiving the insulative housing.

These and other objects of the present invention are achieved in another aspect of the present invention by a method of making a contact. The method includes the steps of: providing a sheet of material; stamping the sheet to form a carrier strip having an edge and a plurality of contacts, each having a mounting end extending from said the of the carrier strip; placing a window in the mounting ends of the contacts; and removing the contacts from said carrier strip.

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Brief Description of the Drawings

Other uses and advantages of the present invention will become apparent to those skilled in the art upon reference to the specification and the drawings, in which:

20 Figure 1 is an elevational view of one alternative embodiment of a contact of the present invention;

Figure 2 is a an elevational view of a series of contacts of the present invention on a carrier strip;

Figure 3 is an enlarged view of a portion of the carrier strip and contact shown in Figure 2;

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Figure 4 is a cross-sectional view of a portion of the carrier strip and contact taken along line IV-IV of Figure 3;

Figure 5 is a plan view of a portion of connector housing capable of receiving a contact of the present invention;

Figure 6 is a cross-sectional view of a portion of the connector housing taken along line VI-VI of Figure 5;

5 Figure 7 is a plan view of the portion of the connector housing shown in Figure 5 with a contact of the present invention inserted therein; and

Figure 8 is a cross-sectional view of the portion of the connector housing and contact taken along line VIII-VIII in Figure 7.

Detailed Description of the Preferred Embodiments

10 Figure 1 displays one alternative embodiment of a contact 10 of the present invention. As discussed in more detail below, contact 10 is part of a connector 100.

Contact 10 has a mating end 11 that extends from connector 100 to interact with a corresponding contact (not shown) extending from a
15 mating connector (not shown). As an example, the blade-type contact shown in Figure 1 preferably interacts with a dual beam contact on the mating connector. However, any type of contact could be used with the present invention.

A mounting end 13 opposes mating end 11 of contact 10. Mounting
20 end 13 preferably includes a notch 15 flanked by arms 17. The wall that defines notch 15 includes a generally smooth transition area 19.

Transition area 19 is an area of reduced thickness, and preferably has a beveled or an arcuate shape as seen in Figure 4. Preferably, transition area 19 is located on an area of the wall of notch 15 closest to mating end
25 11. The benefits of notch 15 and transition area 19 will become more apparent below.

A retention portion 21 extends between mating end 11 and mounting

end 13 of connector 10. Retention portion 21 is the portion of contact 10 that interference fits within connector 100. Retention portion 21 may include anti-wicking apertures 23 that helps prevent the possible wicking of solder towards mating end 11 during later manufacturing steps.

5 The steps of making contact 10 will now be described with reference to Figures 2-4. Machines, such as conventional stamping machines, form a series of contacts 10 on a carrier strip 200. Carrier strip 200 is a sheet of suitable conductive material. In addition to forming the outline of contact 10 and punching anti-wicking apertures 23, the stamping process also
10 forms a window 25 in contact 10.

The portion of the wall that forms window 25 and is located adjacent retention portion 21 is deformed to create transition area 19. Preferably, transition area 19 is a die controlled region. A coining operation preferably forms transition area 19. However, other methods of creating
15 transition area 19 could be used.

After the coining step, a cutting step severs contacts 10 from carrier strip 200, creating discrete contacts. When cut from carrier strip 200, window 25 of contact 10 becomes notch 15. Contacts 10 are placed into connector 100 after severing using known techniques.

20 Connector 100 will now be described with reference to Figures 5-8. Connector 100 includes an insulative housing 101 with an array of apertures 103 extending between a mating surface 105 and a mounting surface 107. Adjacent mating surface 105, each aperture 103 preferably has lead-in surfaces 109, 111. Lead-ins 109, 111 help align contacts 10
25 with apertures 103 during assembly of connector 100.

Apertures 103 also include a reduced width portion between mating surface 105 and mounting surface 107 as seen in Figures 6 and 8. The

reduced width portion forms a retention zone 113 that retains contact 10 using an interference fit. As shown in Figures 5 and 7, retention zone 113 can be a rib that projects inwardly from the walls that form aperture 103. Retention zone 113 can also extend axially along a length of aperture 103. Although shown as a rib, other protuberances could be used to form the reduced width portion.

Since the mating connector preferably has dual beam contacts that mate with contacts 10, insulative housing 101 can include a pair of beam receiving notches 117 that communicate with each aperture 103.

Receiving notches 117 can receive the distal ends of the dual beams during mating with contacts 10. Receiving notches 117 are sized to accommodate the deflection of the dual beams when the dual beam contacts mate with contacts 10.

Connector 100 preferably surface mounts to a substrate (not shown) using reflow techniques, preferably Ball Grid Array (BGA) technology. To assist surface mounting, aperture 103 can have an enlarged portion 115 adjacent mounting surface 107. As shown in Figure 8, enlarged portion 115 is dimensioned to receive at least a portion of a fusible element 117, such as a solder ball. International Publication number WO 98/15989 (International Application number PCT/US97/18066), herein incorporated by reference, describes methods of securing a solder ball to a contact.

The insertion of contact 10 into connector 100 will now be described with reference to Figures 7 and 8. The insertion of contact 10 into connector 100 occurs, using known techniques, after contact 10 is severed from carrier strip 200. Mounting portion 13 of contact 10 enters aperture 103 first. Legs 17 of contact 10 freely pass by retention zone

113 of connector 100 since legs 17 are not aligned with retention zone 113. Transition area 19 of contact 10, however, is aligned with, and engages, retention zone 113 during insertion. Further insertion of contact 10 into connector 100 brings retention portion 21 into engagement with retention zone 113. Due to its shape, transition area 19 does not skive retention zone 113 during insertion. The insertion of contact 10 into connector 100 can be accomplished with automated techniques.

With contact 10 properly seated in connector 100, fusible element 117 can be attached to contact 10 using, for example, the techniques described in International Publication number WO 98/15989 described above. With the present invention, fusible element 117 can attach to contact 10 without the need for an intermediate step of preparing contact 10, such as brushing the skived portion from contact 10.

Dual arms 17 and notch 15 can help improve the security and placement of fusible element 117 on contact 10. First, dual arms 17 and notch 15 provides more surface area upon which fusible element 117 can attach than with conventional contacts. A larger surface area can increase the bonding force between fusible elements 117 and contacts 10.

In addition, notch 15 can help align fusible element 117 on contact 10. During reflow, fusible element 117 flows into the void area formed by notch 15 even if fusible element 117 is not properly centered on contact 10. The reflow of a portion of fusible element 117 into the void causes the displacement of the remainder of fusible element 117 towards the void area. In other words, fusible element 117 moves towards a centered position during reflow. This helps provide a more uniform connector 100.

While the present invention has been described in connection with the preferred embodiments of the various figures, it is to be understood that

other similar embodiments may be used or modifications and additions may be made to the described embodiment for performing the same function of the present invention without deviating therefrom. Therefore, the present invention should not be limited to any single embodiment, but
5 rather construed in breadth and scope in accordance with the recitation of the appended claims.



Claims

WHAT IS CLAIMED IS:

1. A contact insertable into an insulative housing of a connector,
comprising:

- 5 a mating end for receiving a mating contact;
 a retention portion for insertion into the connector; and
 a mounting end opposite said mating end and having a transition area
adapted to pass through the insulative housing without substantially
skiving the insulative housing.

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2. The contact as recited in claim 1, wherein said transition area is a die
controlled region.

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3. The contact as recited in claim 2, wherein said die controlled region is
coined.

4. The contact as recited in claim 1, wherein said transition area is
substantially smooth.

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5. The contact as recited in claim 1, wherein said transition area
comprises an area of reduced thickness.

6. The contact as recited in claim 5, wherein said area of reduced
thickness is tapered.

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7. The contact as recited in claim 1, wherein said mounting end further
comprises a notch defined by a wall; said transition area occupying at



least a portion of said wall.

8. The contact as recited in claim 1, wherein said mounting end further comprises a pair of arms flanking said transition area.

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9. A carrier strip, comprising:

a sheet of material having an edge; and

at least one contact, comprising:

a mounting end extending from said edge and including a window;

10 a retention portion extending from said mounting end; and

a mating end extending from said retention portion.

10. The carrier strip as recited in claim 9, wherein at least a portion of said window is a die controlled region.

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11. The carrier strip as recited in claim 10, wherein said die controlled region is coined.

12. The carrier strip as recited in claim 9, wherein a wall defines said
20 window, at least a portion of said wall having a deformed area.

13. The carrier strip as recited in claim 12, wherein said deformed area is adjacent said retention portion.

25 14. The carrier strip as recited in claim 12, wherein said deformed area is substantially smooth.

This Sheet Has Been Replaced



THIS SHEET HAS BEEN
REPLACED



15. The carrier strip as recited in claim 9, wherein said deformed area is tapered.

16. A connector, comprising:

5 an insulative housing with at least one aperture therethrough; and
a contact insertable within said aperture and comprising:

a mating end for receiving a mating contact;

a retention portion for engaging the connector; and

a mounting end opposite said mating end and having a die

10 controlled region adjacent said retention portion and adapted to pass
through the insulative housing without substantially skiving the
insulative housing.

17. The connector as recited in claim 16, wherein said die controlled
15 region is coined.

18. The connector as recited in claim 16, wherein said die controlled
region is tapered.

20 19. The connector as recited in claim 18, wherein said die controlled
region is rounded.

20. The connector as recited in claim 16, wherein said mounting end
further comprises a notch defined by a wall; said transition area
25 occupying at least a portion of said wall.

21. The connector as recited in claim 16, wherein said mounting end



further comprises a pair of arms flanking said transition area.

22. The connector as recited in claim 16, further comprising a fusible element attachable to said contact.

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23. The connector as recited in claim 22, wherein said fusible element is a solder ball.

24. A method of making a contact, comprising the steps of:

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providing a sheet of material;

stamping said sheet to form a carrier strip having an edge and a plurality of contacts, each contact having a mounting end extending from said edge of said carrier strip;

placing a window in said mounting ends of said contacts; and

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removing said contacts from said carrier strip;

whereby said contacts can pass through an insulative housing of a connector without substantially skiving the insulative housing.

25. The method of making a contact as recited in claim 24, further

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comprising the step of die controlling a region of said windows.

26. The method of making a contact as recited in claim 25, wherein the die controlling step comprises the step of coining a region of said windows.

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27. The method of making a contact as recited in claim 24, further comprising the step of deforming at least a portion of said windows of said



contacts.

28. The method of making a contact as recited in claim 27, wherein
said deforming step comprises the step of smoothing at least a portion of
5 said windows.

29. The method of making a contact as recited in claim 27, wherein
said deforming step comprises the step of tapering said portion of said
windows.

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30. The method of making a contact as recited in claim 27, wherein the
deforming step comprises the step of deforming a portion of said windows
opposite said edge of said carrier strip.

15 31. The method of making a contact as recited in claim 24, wherein the
removing step comprises cutting said contacts across said mounting
ends, whereby the cut passes through said windows.

32. The method of making a contact as recited in claim 24, wherein the
20 removing step occurs after the window placing step.