POST-PROCESSING SYSTEM AND METHOD

Field of the Invention

The invention relates to the application of EMI shielding to integrated circuits in order to use said ICs in compact devices to mitigate electromagnetic interference.

Background

The application of EMI shielding to integrated circuits to mitigate inference between closely packed components introduces various processing difficulties.

For instance, having a substrate template with an adhesive film upon which the ICs are placed during the application of the EMI shielding requires the strength of the adhesive engagement of the ICs to be high. However, to remove said ICs using an application of force such as a pin to push the ICs away from the film may be difficult. A compromise between adhesive strength to maintain consistent orientation and yet be able to remove the ICs is a compromise on quality affecting the precision of IC placement.

Further, once removed, the residual shielding material applied to the ICs will inevitably extend to the peripheral area about the IC units. On removal of the IC units the residual material may not break cleanly leaving shielding material burrs attached to the IC units. It follows that any unintended conductive material on the IC units poses a hazard to the

operational efficiency and effectiveness of the IC unit. Consequently, the burrs need to be prevented or removed prior to use of the IC units.

Summary of Invention

In a first aspect, the invention provides a de-burring system for removing burrs from IC units, the system comprising: a shear plate having a plurality of pockets; each pocket shaped to receive one of said IC units; wherein each pocket includes at least one dimension sized to shear a burr from opposed sides of said IC unit.

In a second aspect, the invention provides a method for removing burrs from IC units, the method comprising the steps of: inserting an IC unit into a pocket within a shearing plate, said pocket shaped to receive one of said IC units, and at least one dimension sized to shear a burr from opposed sides of said IC unit, and so; shearing said burr from each side of the IC unit.

In a third aspect, the invention provides a method for removing an IC unit from an adhesive film, the method comprising the steps of: applying heat to an underside of said film for a pre-determined time at a pre-determined temperature; reducing adhesive strength of said adhesive and so reducing the required force to remove said IC unit, and; removing said IC unit.

In a first aspect the application of a dissipating environment to reduce the adhesive strength of the film in combination with the application of mechanical force facilitates the removal of the IC units. In one embodiment, changes in environmental conditions, such as a heating chamber, may provide an environmental condition whereby the adhesive strength is reduced under controlled conditions. As an alternative embodiment, the application of a hot air stream for a predetermined length of time may be sufficient to reduce the adhesive strength.

In a second embodiment, having a shearing plate into which the IC units may be inserted will shear off the burrs without damaging the IC units. The shear plate may be placed procedurally intermediate the substrate template and downstream unloading of the IC units so as to provide a limited delay in the process whilst solving a significant problem for the later use of said IC units.

Brief Description of Drawings

It will be convenient to further describe the present invention with respect to the accompanying drawings that illustrate possible arrangements of the invention. Other arrangements of the invention are possible and consequently, the particularity of the accompanying drawings is not to be understood as superseding the generality of the preceding description of the invention.

Figure 1 is a schematic view of an IC removal system according to one embodiment of the present invention;

Figure 2 is an elevation view of a precision picker engaged with an IC unit according to a further embodiment of the present invention;

Figure 3 is an elevation view of a deburring process according to one embodiment of the present invention;

Figures 4A and 4B are elevation sequential views of the deburring process according to the embodiment of Figure 3;

Figure 5 is an elevation view of a shearing plate according to one embodiment of the present invention;

Figure 6 is an elevation view of a polishing unit according to one embodiment of the present invention;

Figure 7 is an elevation view of an inspection station according to one embodiment of the present invention, and;

Figures 8A and 8B are plan views of alternative pocket shapes according to further embodiments of the present invention.

Detailed Description

Figures 1 and 2 show one embodiment of an IC removal system arranged to facilitate the removal of IC units from an adhesive film 15. The adhesive strength is subject to a change in environmental conditions for the removal of IC units. The system 5 in this case includes a hot air source 25 projecting hot air 30 to an underside of a substrate template 10 for a predetermined time. The template 10 includes an adhesive film 15 upon which IC units 20 have been placed. In this arrangement, the EMI shielding has already been placed on the IC units.

The application of hot air 30 is provided for a pre-determined amount of time, with the hot air being of a particular temperature. The actual time and temperature will vary with the type of adhesive being used. As an example for a typical adhesive used for this application, a time of 5 to 10 seconds having a temperature of 35°C may be sufficient. This may vary considerably for different applications. By way of a non-limiting example, the heating time may be 5 to 10 seconds before the application of a mechanical force, such as a lifting pin, to push ICs and continue to blow until all the ICs removed. The temperature may be in the range of 50°C to 150°C, but depends on different ICs

The applied heat reduces the adhesive strength of the film 15 such that the application of a removal force (not shown) is sufficient to overcome the adhesion.

A picker 35 is then free to engage the IC unit 40 with the picker head 40 applying a vacuum sufficient to pull the IC unit free from the affected adhesive film 15. In this embodiment, the picker is a precision picker, capable of at least 4 degrees of freedom, being movement in the horizontal plane (X,Y) and vertically (Z) as well as rotation about the vertical axis (θ). Each of these movements is capable of a high degree of precision (±3 microns). Whilst such precision is not required for the IC removal system, when the removal system is used with the de-burring system, the use of a high precision picker will become apparent.

In a further embodiment, the IC unit 45, which is engaged to the vacuum head 40 of the picker, is seen in Figure 3. A shear plate 50 having a plurality of pockets 55, 60, 65 is then provided so that the IC unit 45 having a burr 80, as shown in Figures 4A and 4B, is inserted 85 into a pocket 55. The sharp edge 90 of the shear plate 50 then shears through the burr 80 thus leaving a deburred IC unit 45 having overcome the significant processing fault previously mentioned.

As shown in Figure 3, the detritus 70, being the removed burrs, is drawn down through an extractor 72 under a vacuum suction 75 so as to maintain a clean environment.

It will be noted that different IC units 45 may have different tolerance requirements. Thus, the shear plate 50 may have different pockets 60, 65 having different tolerances to match different IC units. Accordingly, in a further embodiment a shear plate 50 may

have pockets 55, 60, 65 of different size or tolerances so as to be more universally applicable to a range of different units. Given the high degree of tolerance required to remove the burr 80, the precision picker is well suited to accurately lower and raise the IC unit, as well as orient the unit by rotating about the vertical axis to accommodate any misalignment during the removal from the adhesive film, before inserting into the respective pocket.

Following the removal of the IC unit 45, to maintain the cleanliness of the shear plate 50, an adhesive roller 90 may pass 95 across a top surface of the shear plate 50. This will have a double operation to engage and remove any burrs that may be remaining on the top surface of the shear plate 50. Further, any burrs not picked up by the roller may be pushed through the pockets 55, 60, 65 for removal 100 by the extractor 72.

Figure 6 shows a further embodiment whereby to ensure the final removal of burrs, including separated burrs which may be adhering to the IC unit, the IC unit may be placed by the picker into a polishing station. The polishing station may have twin rotating brushes 110. In this embodiment, the two brushes rotate counter to each other so as to engage the IC unit and sweep detritus 120 downwards to be removed by the extractor 72.

As mentioned, the precision picker which may be adopted for this process may also be rotatable 105 such that the brushes act on a first pair of opposed sides in a first action with the picker rotating 105 the IC unit so as to then engage the second pair of opposed

sides. Thus, for this final burr removal the IC unit may first be placed between the brushes then rotated and once again placed between the brushes so as to remove any detritus from the periphery of the IC unit.

Figure 7 shows a final step whereby the picker 130 places the IC unit above an inspection station having a camera 140 so as to ensure all burrs have been removed. Given that the burrs are caused by residual EMI shielding material, inspection from below to ensure no material projects beyond the plan view of the IC units is required.

It will be appreciated that the pockets may be shaped to either shear two sides of the IC unit at a time or four sides, depending upon the arrangement of the shear plate.

Figures 8A and 8B show alternative arrangements of shearing burrs from an IC unit 155, 170. In the first embodiment of Figure 8A, a shear plate 145 may have pockets 150 that are shaped to receive an IC unit 155. The dimensions of the pocket such that each peripheral edge 157 is a shearing edge. Thus on insertion of the IC unit into the pocket 150, burrs are sheared from each side of the IC unit 155 by the peripheral edges.

In the alternative arrangement of Figure 8B, again the pocket 165 is shaped to receive an IC unit 170. However, in this embodiment, only two opposed peripheral sides or edges 175 have a sufficiently high tolerance to act as shearing edges, and so the pocket has only one dimension sized to shear opposed sides of the IC unit. The other sides 180 are dimensioned further apart, so that they do not contact the IC unit 170 on insertion. It

will be envisaged that the dimension separating the non-shearing sides 180 may be very large and possibly be a slot such that two IC units could be inserted side by side and simultaneously shear two respective sides of the IC unit. Once the first pair of sides is sheared. The IC unit may them be rotated using the precision picker and re-inserted to complete the process.

Whilst the embodiment of Figure 8A has the advantage of a single insertion step, the embodiment of Figure 8B only requires two shearing edges of high tolerance, reducing manufacturing cost. Further, the embodiment of Figure 8B may accommodate advances in the EMI shield process that may eliminate burrs on one pair of sides. Thus both embodiments have advantages that may be selected depending upon the process.

Further, whilst the shape of the pockets and IC units are represented as rectangular, other shapes of IC unit, having two or more shearing edges, are also possible within the scope of the invention.

Claims

1. A de-burring system for removing burrs from IC units, the system comprising

a shear plate having a plurality of pockets;

each pocket shaped to receive one of said IC units;

wherein each pocket includes at least one dimension sized to shear a burr from opposed peripheral sides of said IC unit;

wherein each peripheral edge of the pocket is arranged to shear burrs from each peripheral side of said IC unit; and

wherein said each peripheral edge of the pocket is a shearing edge.

2. The system according to claim 1, wherein only two opposed peripheral edges of the pocket is arranged to shear burrs from each peripheral side of said IC unit.

3. The system according to claim 1 or 2, further including a precision picker arranged to engage and insert the IC unit into the pocket, said precision picker having at least 4 degrees of freedom, one of said degrees of freedom being rotation about a vertical axis.

4. The system according to any one of claims 1 to 3, further including an extractor arranged to remove detritus resulting from the removed burrs.

5. The system according to any one of claims 1 to 4, further including a roller arranged to pass over a top surface of said shear plate, the roller arranged to remove detritus from the top surface.

6. The system according to any one of claims 1 to 5, further including a polishing station comprising counter rotating brushes, said brushes arranged to remove detritus adhering to the IC unit on placement of the IC unit in contact with said brushes.

7. A method for removing burrs from IC units placed on an adhesive film of a substrate template, the method comprising the steps of:

inserting an IC unit into a pocket within a shearing plate, said pocket shaped to receive one of said IC units, and at least one dimension sized to shear a burr from opposed peripheral sides of said IC unit, and so;

shearing said burr from each peripheral side of the IC unit using each peripheral edge of the pocket;

wherein said each peripheral edge is a shearing edge.

8. The method according to claim 7, further comprising the steps of:

applying heat to an underside of the adhesive film for a pre-determined time at a pre-determined temperature;

reducing adhesive strength of said adhesive film and so reducing the required force to remove said IC unit, and;

removing said IC unit.

9. The method according to claim 8, wherein the removing step includes the steps of engaging the IC unit with a picker and lifting the IC unit from the adhesive film.

10. The method according to claim 8 or 9, further including the step of applying a force to the IC unit to assist in the removal of said IC unit.