CLAIMS

1. A method for preparing a die for packaging comprising:

providing a die having first and second major surfaces;

forming vias on the first major surface of the die;

forming a mask layer on the first major surface, the mask comprises mask openings exposing the vias;

filling the mask openings with a conductive material; and

reflowing to at least partially fill the vias and contact openings to form via contacts in the vias and surface contacts in the mask openings.

2. The method of claim 1 wherein the conductive material comprises solder.

3. The method of claim 1 wherein filling the mask opening comprises printing with solder paste using a stencil.

4. The method of claim 3 comprises removing the stencil after filling the mask openings.

5. The method of claim 1 comprises forming a die attach film on the mask layer for attaching another die on the first surface of the die.

6. The method of claim 1 wherein the die comprises a wafer having a plurality of dies and comprises:

forming a die attach film on the wafer to cover the first major surface of the dies; and

dicing the wafer to separate the plurality of dies into individual dies.

7. The method of claim 1 comprises backgrinding the second major surface to expose bottom of the via contacts.

8. The method of claim 7 wherein the die comprises a wafer having a plurality of dies and comprises:

forming a die attach film on the wafer to cover the first major surface of the dies; and

dicing the wafer to separate the plurality of dies into individual dies after backgrinding.

9. The method of claim 1 wherein:

the vias comprise blind vias; and

comprises backgrinding the second major surface to expose bottom of the via contacts.

10. The method of claim 9 wherein the die comprises a wafer having a plurality of dies and comprises:

forming a die attach film on the wafer to cover the first major surface of the dies; and

dicing the wafer after backgrinding to separate the plurality of dies into individual dies.

11. The method of claim 1 comprises forming a die stack having n number of dies comprises stacking a n^{th} die on top of a $n^{th} - 1$ die, wherein via contacts of the n^{th} die are disposed above surface contacts of the $n^{th} - 1$.

12. The method of claim 11 wherein:

upper dies of the stack comprises second major surfaces with exposed bottom via contacts; and

a bottom die of the stack (n = 1) comprises an ungrinded second major surface with unexposed via contacts.

13. The method of claim 12 comprises backgrinding the second surface of the bottom die to expose bottom of the via contacts.

14. The method of claim 12 wherein the bottom die comprises a bottom wafer with a plurality of bottom dies.

15. The method of claim 14 comprises:

forming die stacks on the bottom dies of the bottom wafer;

backgrinding the bottom wafer to expose bottom of the via contacts; and

dicing the bottom wafer to separate into a plurality of individual die stacks.

16. A method of packaging comprising:

providing n number of dies having via contacts through the major surfaces of the dies;

stacking the n number of dies to form a die stack, where n = 1 is the bottom die, n = n is the top die of the stack, wherein vias on the n^{th} die is coupled to vias of adjacent die or dies; and

wherein at least one of the dies of the stack comprises a reflowed type die, the reflowed type die comprises

a die substrate having first and second major surfaces and vias through the major surfaces,

a mask on the fist major surface having contact openings corresponding to the vias, and

via contacts in the vias and surface contacts in the contact openings, wherein forming the contacts comprises filling the contact openings with a conductive material and reflowing to fill the via openings.

17. A die comprising:

a die substrate having first and second major surfaces;

vias passing through first and second surfaces of the die;

a contact mask on the first major surface, the contact mask comprises mask openings corresponding to the vias; and

a conductive material filling the vias and mask openings to form via contacts in the vias and surface contacts in the mask openings.

18. The die of claim 17 wherein the conductive material comprises solder.

19. The die of claim 17 wherein the via contacts comprises reflowed solder.

20. The die of claim 17 comprises a die attach film on the contact mask.

CLAIMS

1. A method of making an interconnection for a semiconductor device comprising:

(a) providing a first semiconductor device having first and second major surfaces;

(b) forming a via through the first major surface of the first semiconductor device;

(c) forming a mask layer on the first major surface, the mask layer comprising a mask opening to expose the via;

(d) providing a conductive material;

(e) heating the conductive material to form a through via contact, wherein the through via contact at least partially fills the via and the through via contact partially fills the mask opening;

(f) exposing the through via contact from the second major surface;

(g) repeating step (a) to (f) to provide a second semiconductor device;

(h) stacking the first semiconductor device on the second semiconductor device to form a stack structure; and

(i) reflowing the conductive material of the through via contact of the first semiconductor device such that the partially filled mask opening of the second semiconductor device is completely filled by the reflowed conductive material of the through via contact of the first semiconductor device to form an interconnection between the first and the second semiconductor devices.

2. The method of claim 1 wherein the conductive material comprises solder.

3. The method of claim 1 wherein step (d) comprises disposing the conductive material in the mask opening.

4. The method of claim 3 wherein disposing the conductive material comprises printing with solder paste using a stencil.

5. The method of claim 4 comprising removing the stencil after printing.

6. The method of claim 1 wherein the mask layer comprises a die attach film for attaching another semiconductor device on the first major surface of the first semiconductor device.

7. The method of claim 1 wherein the bottom of the through via contact is coplanar with the second major surface of the first semiconductor device after step (f).

8. The method of claim 7 wherein the through via contact is in direct contact with sidewalls of the via such that there is no gap therebetween.

9. The method of claim 1 wherein both the first semiconductor device and the second semiconductor device are wafers.

10. The method of claim 9 further comprising separating the stacked structure into a plurality of individual die stacks.

11. The method of claim 1 further comprising attaching a flip chip to the first major surface of the first semiconductor device.

12. The method of claim 1 further comprising attaching the stacked structure to a wafer.

13. A method of packaging comprising:

providing at least a first first-type die, wherein the first-type die comprises first and second major surfaces and is formed by

forming a via through the first major surface of the first-type die,

forming a mask layer on the first major surface, the mask layer comprising a mask opening in communication with the via, and

forming a through via contact having a via portion and an upper portion, wherein the through via contact is formed by

providing a single conductive material in the mask opening, and

reflowing the single conductive material, wherein the single conductive material flows down and at least partially fills the via which correspond to the via portion and the single conductive material partially fills the mask opening leaving some spaces therein which correspond to the upper portion, and

exposing a bottom of the through via contact such that the bottom of the via contact is coplanar with the second major surface of the first-type die; and

stacking a second die over the first first-type die to form a die stack.

14. The method of claim 13 wherein:

the second die is a second first-type die, and wherein the second first-type die is stacked over the first first-type die such that the mask layer of the first first-type die below contacts the second major surface of the second first-type die above, and wherein the through via contact of the second first-type die above is aligned with the partially filled mask opening of the first first-type die below.

15. The method of claim 13 comprising:

reflowing the single conductive material of the through via contact of the second first-type die such that the partially filled mask opening of the first first-type die is completely filled by the reflowed conductive material of the through via contact of the second first-type die to form an interconnection between the first and the second first-type dies.

16. The method of claim 13 wherein the second die comprises a flip chip having die contacts on a bottom surface of the flip chip.

17. The method of claim 16 comprising:

reflowing conductive material of the die contact of the flip chip such that the partially filled mask opening of the first first-type die is completely filled by the reflowed conductive material of the die contact of the flip chip to form an interconnection between the flip chip and the first first-type die.

18. A method of preparing a die for stacking comprising:

providing a die having first and second major surfaces;

forming a via through the first major surface of the die;

forming a mask layer on the first major surface, the mask layer comprising a mask opening in communication with the via;

forming a through via contact having a via portion and an upper portion, wherein the through via contact is formed by

providing a single conductive material in the mask opening, and

reflowing the single conductive material, wherein the single conductive material flows down and at least partially fills the via which correspond to the via portion and the

single conductive material partially fills the mask opening leaving some spaces therein which correspond to the upper portion;

exposing a bottom of the through via contact such that the bottom of the via contact is coplanar with the second major surface of the die.

19. The method of claim 18 wherein the bottom of the through via contact is exposed by backgrinding the second major surface of the die.

20. The method of claim 18 wherein the single conductive material comprises solder.

21. The method of claim 18 wherein the through via contact is a single unitary contact having no seam or interface exist between the via and upper portions.