

**Claims**

1. A method for device packaging, the method comprising:

heating a semiconductor device to a first temperature, the semiconductor device comprising a plurality of bump structures, each of the plurality of bump structures comprising a solder portion, the first temperature being at least the melting temperature of the solder portion of each of the plurality of bump structures to bring the solder portion to a molten state;

heating a substrate to a second temperature, the substrate comprising a plurality of contact pads; and

spatially aligning the plurality of bump structures with the plurality of contact pads,

wherein the semiconductor device is disposed at a distance from the substrate during the heating of the semiconductor device to the first temperature, at least one of the semiconductor device and the substrate being displaced towards the other thereof subsequent the heating of the semiconductor device for abutting each of the plurality of bump structures with a corresponding one of the plurality of contact pads.

2. The method as in claim 1, heating the substrate comprising:

heating the substrate to a second temperature, the second temperature being lower than the first temperature.

3. The method as in claim 2, the second temperature being lower than the melting temperature of the solder portion of each of the plurality of bump structures

4. The method as in claim 2, further comprising:

displacing at least one of the semiconductor device and the substrate towards the other thereof for abutting each of the plurality of bump structures with a corresponding one of the plurality of contact pads to thereby obtain a semiconductor device package therefrom

5. The method as in claim 4, heating the semiconductor device to the first temperature comprising:



heating the semiconductor device to a third temperature, the third temperature being lower the melting temperature of the solder portion of each of the plurality of bump structures; and

5 gripping the semiconductor device with a gripper tool, the gripper tool for heating the semiconductor device to the first temperature.

6. The method as in claim 5, heating the semiconductor device to a third temperature comprising:

10 displacing the semiconductor device across a plurality of heating elements, the heating elements being operated for generating a heat profile thereacross, the heat profile being controlled for gradual heating of the semiconductor device to the third temperature.

- 15 7. The method as in claim 6, heating the semiconductor device to a third temperature further comprising:

disposing the semiconductor device on a plate, the plate being displaceable for displacing the semiconductor device across the plurality of heating elements.

- 20 8. The method as in claim 7, heating the semiconductor device to a third temperature further comprising:

displacing the semiconductor device in one of rotationally and linearly for disposing the semiconductor device on the plate in a required orientation; and

25 determining height of the semiconductor device with reference to a datum defined by the plate.

9. The method as in claim 4, heating the substrate to a second temperature comprising:

30 disposing the substrate on a first holder, the first holder for heating the substrate to a fourth temperature, the fourth temperature being lower the second temperature; and

disposing the substrate on a second holder subsequent the substrate reaching the fourth temperature, the second holder for heating the substrate to the second temperature.

5 10. The method as in claim 9, further comprising:

 depositing fluxing agent onto the plurality of contact pads when the substrate is disposed on the first holder, the second temperature being lower than the activation temperature of the fluxing agent.

10 11. The method as in claim 9, further comprising:

 depositing at least one underfill material onto the plurality of contact pads when the substrate is disposed on the first holder, the second temperature being lower the curing temperature of underfill material.

15 12. The method as in claim 9, further comprising:

 determining height of the device carrier with reference to a datum defined by the second holder subsequent the heating of the substrate to the second temperature.

20 13. The method as in claim 4, spatially aligning the plurality of bump structures with the plurality of contact pads comprising:

 defining a first coordinate system on the semiconductor device and a plurality of reference axes intersecting and configuratively corresponding with the plurality of bump structures;

25 defining a second coordinate system on the substrate and a plurality of reference vertices coinciding and configuratively corresponding with the plurality of contact pads of the substrate; and

 aligning the first coordinate system with the second coordinate system for substantially coinciding each of the plurality of reference axes with a corresponding one of the plurality of reference vertices to thereby spatially align the plurality of bump structures with the plurality of contact pads.

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14. A system for packaging a device, the system comprising:

means for heating a semiconductor device to a first temperature, the semiconductor device comprising a plurality of bump structures, each of the plurality of bump structures comprising a solder portion, the first temperature being at least a melting temperature of the solder portion of each of the plurality of bump structures to bring the solder portion to a molten state;

means for heating a substrate to a second temperature, the substrate having a plurality of contact pads; and

means for spatially aligning the plurality of bump structures with the plurality of contact pads,

wherein the semiconductor device is disposed at a distance from the substrate during the heating of the semiconductor device to the first temperature, at least one of the semiconductor device and the carrier device being displaced towards the other thereof subsequent the heating of the semiconductor device to the first temperature for abutting each of the plurality of bump structures with a corresponding one of the plurality of contact pads.

15. The system as in claim 14, wherein the second temperature is lower than the first temperature.

16. The system as in claim 15, wherein the second temperature is lower than the melting temperature of the solder portion of each of the plurality of bump structures.

17. The system as in claim 15, further comprising:

means for displacing at least one of the semiconductor device and the device carrier towards the other thereof for abutting each of the plurality of bump structures with a corresponding one of the plurality of contact pads to thereby obtain a semiconductor device package therefrom.

18. The system as in claim 17, further comprising:

a gripper tool for gripping the semiconductor device, the gripper tool for heating the semiconductor device to the first temperature.

19. The system as in claim 18, further comprising:

a plurality of heating elements, the plurality of heating elements operable for generating a heat profile thereacross, the heat profile being controllable for gradual heating of the semiconductor device to a third temperature, the third temperature being lower than the melting temperature of the solder portion of each of the plurality of bond structures.

20. The system as in claim 19, further comprising:

a plate for disposing the semiconductor device across the plurality of heating elements.

21. The system as in claim 20, further comprising:

means for displacing the semiconductor device one of rotationally and linearly for disposing the semiconductor device on the plate in a predetermined orientation; and

means for determining height of the semiconductor device with reference to a datum defined by the plate.

22. The system as in claim 17, further comprising:

a first holder for heating the substrate to a fourth temperature, the fourth temperature being lower the second temperature;

a second holder for heating the substrate to the second temperature; and

means for disposing the substrate onto the second holder subsequent the substrate reaching the fourth temperature.

23. The system as in claim 22, further comprising:

means for depositing fluxing agent onto the plurality of the contact pads when the substrate is disposed on the first holder, the second temperature being lower than an activation temperature of the fluxing agent.

24. The system as in claim 23, wherein the fourth temperature is lower the activation temperature of the fluxing agent.

25. The system as in claim 22, further comprising:

means for depositing an underfill material on onto the plurality of the contact pads when the substrate is disposed on the first holder, the second temperature being lower a curing temperature of the underfill material.

5 26. The system as in claim 22, further comprising:

 means for determining height of the device carrier with reference to a datum defined by the second holder subsequent the heating of the device carrier to the second temperature.

10 27. The system as in claim 14, the means for spatially aligning the plurality of bump structures with the plurality of contact pads comprising:

 means for defining a first coordinate system on the semiconductor device and a plurality of reference axes intersecting and configuratively corresponding with the plurality of bump structures;

15 means for defining a second coordinate system on the substrate and a plurality of reference vertices coinciding and configuratively corresponding with the plurality of contact pads of the substrate; and

 means for aligning the first coordinate system with the second coordinate system for substantially coinciding each of the plurality of reference axes with a corresponding one of the plurality of reference vertices to thereby spatially align the plurality of bump structures with the plurality of contact pads.

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