Claims

What is claimed:

1. A method of making a semiconductor device, comprising:

providing a plurality of semiconductor die;

depositing an encapsulant around and over the semiconductor die;

forming a first insulating layer over an active surface of the semiconductor die and in contact with the encapsulant;

forming an interconnect structure over the first insulating layer and semiconductor die by,

(a) forming a conductive layer, and

(b) forming a bump over the conductive layer, wherein the entire interconnect structure is disposed within a footprint of the semiconductor die as a fan-in interconnect structure;

forming a protection layer over a top surface of the encapsulant and over a second surface of the semiconductor die opposite the active surface; and

singulating the plurality of semiconductor die through the protective layer, encapsulant, and first insulating layer to leave a thickness of the encapsulant disposed over a side surface of the semiconductor die less than 100 micrometers and the first insulating layer and protection layer terminating at an outside surface of the encapsulant.

2. The method of claim 1, further including removing a portion of the encapsulant to leave the top surface of the encapsulant coplanar with the second surface of the semiconductor die.

3. The method of claim 1, further including forming a second insulating layer over the conductive layer, wherein the second insulating layer terminates at the outside surface of the encapsulant.

4. The method of claim 1, wherein the protective material includes a transparent material or translucent material.

5. The method of claim 1, wherein the protective material includes an opaque material.

6. The method of claim 1, wherein the thickness of the encapsulant disposed over the side surface of the semiconductor die ranges from 30 to 50 micrometers.

7. A method of making a semiconductor device, comprising:

providing semiconductor die;

depositing an encapsulant around and over the semiconductor die;

forming a first insulating layer over the encapsulant and a first surface of the semiconductor die;

forming an interconnect structure over the first insulating layer and semiconductor die by,

(a) forming a conductive layer, and

(b) forming a bump over the conductive layer, wherein the entire interconnect structure is disposed within a footprint of the semiconductor die; and

forming a protection layer over a top surface of the encapsulant and over a second surface of the semiconductor die opposite the first surface of the semiconductor die, wherein a thickness of the encapsulant disposed over a side surface of the

semiconductor die is less than 100 micrometers and the first insulating layer and protection layer terminate at an outside surface of the encapsulant.

8. The method of claim 7, further including removing a portion of the encapsulant to leave the top surface of the encapsulant coplanar with the second surface of the semiconductor die.

9. The method of claim 7, further including forming a second insulating layer over the conductive layer, wherein the second insulating layer terminates at the outside surface of the encapsulant.

10. The method of claim 7, wherein the protective material includes a transparent material or translucent material.

11. The method of claim 7, wherein the protective material includes an opaque material.

12. The method of claim 7, wherein the thickness of the encapsulant disposed over the side surface of the semiconductor die ranges from 30 to 50 micrometers.

13. A method of making a semiconductor device, comprising:

providing a semiconductor die;

depositing an encapsulant around and over the semiconductor die;

forming a first insulating layer over the encapsulant and a first surface of the semiconductor die;

forming an interconnect structure over the first insulating layer and semiconductor die by,

(a) forming a conductive layer, and

(b) forming a bump over the conductive layer, wherein the interconnect structure is disposed within a footprint of the semiconductor die; and

forming a protection layer over a surface of the encapsulant and over a second surface of the semiconductor die opposite the first surface of the semiconductor die, wherein a thickness of the encapsulant disposed over a side surface of the semiconductor die is less than 100 micrometers.

14. The method of claim 13, further including removing a portion of the encapsulant to leave the surface of the encapsulant coplanar with the second surface of the semiconductor die.

15. The method of claim 13, wherein the first insulating layer and protection layer terminate at an outside surface of the encapsulant.

16. The method of claim 13, further including forming a second insulating layer over the conductive layer, wherein the second insulating layer terminates at an outside surface of the encapsulant.

17. The method of claim 13, wherein the protective material includes a transparent material or translucent material.

18. The method of claim 13, wherein the protective material includes an opaque material.

19. The method of claim 13, wherein the thickness of the encapsulant disposed over the side surface of the semiconductor die ranges from 30 to 50 micrometers.

20. A method of making a semiconductor device, comprising:

providing a semiconductor die;

depositing an encapsulant around and over the semiconductor die;

forming a first insulating layer over the encapsulant and a first surface of the semiconductor die; and

forming an interconnect structure over the first insulating layer and semiconductor die by,

(a) forming a conductive layer, and

(b) forming a bump over the conductive layer, wherein the interconnect structure is disposed within a footprint of the semiconductor die;

wherein a thickness of the encapsulant disposed over a side surface of the semiconductor die is less than 100 micrometers.

21. The method of claim 20, wherein the first insulating layer terminates at an outside surface of the encapsulant.

22. The method of claim 20, wherein a thickness of the encapsulant over the semiconductor die is at least 100 micrometers.

23. The method of claim 20, wherein the thickness of the encapsulant disposed over the side surface of the semiconductor die ranges from 30 to 50 micrometers.