Claims

What is claimed:

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

providing a ~~temporary~~ carrier;

disposing~~mounting~~ a semiconductor die over the ~~temporary~~ carrier;

depositing an encapsulant over the semiconductor die and ~~temporary~~ carrier;

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

forming a plurality of first vias extending through the first insulating layer and semiconductor die while mounted to the ~~temporary~~ carrier;

forming a plurality of second vias extending through the first insulating layer and encapsulant while the semiconductor die is mounted to the ~~temporary~~ carrier;

~~depositing electrically conductive material in the first vias to form conductive through silicon vias (TSV);~~

~~depositing electrically conductive material in the second vias to form conductive through mold vias (TMV)~~

depositing a first electrically conductive material in the first vias extending through the first insulating layer and semiconductor die to form a plurality of first conductive vias;

depositing a second electrically conductive material in the second vias to form a plurality of second conductive vias;

forming a first interconnect structure over the first insulating layer and electrically connected to the first conductive vias~~TSV~~ and second conductive vias~~TMV~~; and

~~removing the temporary carrier; and~~

forming a second interconnect structure over the semiconductor die and encapsulant opposite the first interconnect structure and electrically connected to the first conductive ~~TSV~~vias and second conductive ~~TMV~~vias.

2. The method of claim 1, wherein the first conductive ~~TSV~~vias are electrically connected to a plurality of contact pads on the semiconductor die or a~~n active~~ surface of the semiconductor die.

3. The method of claim 1, further including~~:~~

~~Depositing~~ disposing ~~the electrically conductive material over sidewalls of the first vias to form the conductive TSV; and~~

~~forming~~ a second insulating material ~~in~~over the first conductive vias ~~over the conductive TSV~~.

4. The method of claim 1, further including~~:~~

forming a plurality of bumps on~~ contact pads of the semiconductor die prior to mounting the semiconductor die over the temporary carrier; and~~

~~mounting the semiconductor die with bumps to the temporary carrier~~ a plurality of contact pads of the semiconductor die prior to disposing the semiconductor die over the carrier.

5. The method of claim 4, further including depositing the encapsulant or an underfill material around the bumps and beneath the semiconductor die.

6. The method of claim 1, further including~~ forming a second insulating material over sidewalls of the first vias and second vias prior to depositing the electrically conductive material to form the conductive TSV and conductive TMV~~ disposing a second insulating material over a sidewall of the first conductive vias or second conductive vias.

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

providing a carrier;

~~mounting~~ disposing a semiconductor die over the carrier;

depositing an encapsulant over the semiconductor die and

carrier;

forming a ~~plurality of~~ first via~~s~~ through the semiconductor die while mounted to the carrier;

forming a ~~plurality of~~ second via~~s~~ through the encapsulant while mounted to the carrier ~~in the same direction as the first vias~~;

depositing a first electrically conductive material in the first via~~s~~ to form a first conductive via~~s~~ through ~~and in the second vias to form second conductive vias~~ the semiconductor die and protruding from a surface of the semiconductor die opposite the carrier;

~~forming a first interconnect structure over the encapsulant and electrically connected to the first conductive vias and second conductive vias~~ depositing a second electrically conductive material in the second via to form a second conductive via;

~~removing the carrier; and~~ forming a first interconnect structure over the encapsulant and electrically connected to the first and second conductive vias; and

forming a second interconnect structure over the encapsulant opposite the first interconnect structure and electrically connected to the first ~~conductive~~ and second conductive vias.

8. The method of claim 7, further including:

planarizing the encapsulant and the ~~with a back~~ surface of the semiconductor die prior to ~~mounting~~ forming the first interconnect structure; and

forming an insulating layer over the semiconductor die and encapsulant.

9. The method of claim 7, further including~~:~~

~~depositing the electrically conductive material over sidewalls of the first vias to form the first conductive vias; and~~

~~forming~~ disposing an insulating material ~~in~~ over the first ~~vias over the first~~ conductive via~~s~~.

10. The method of claim 7, further including~~:~~

forming a bump~~s~~ on a contact pad~~s~~ of the semiconductor die prior to ~~mounting~~disposing the semiconductor die over the carrier~~; and~~

~~mounting the semiconductor die with bumps to the carrier~~.

11. The method of claim 10, further including depositing the encapsulant or an underfill material around the bump~~s~~ and beneath the semiconductor die.

12. The method of claim 7, further including~~ forming an insulating material over sidewalls of the first vias and second vias prior to depositing the electrically conductive material to form the first conductive vias and second conductive vias~~ disposing an insulating material over a sidewall of the first or second conductive via.

13. The method of claim 7, further including:

stacking a first and second ~~plurality of the~~ semiconductor device~~s~~; and

electrically connecting the first and second ~~stacked~~ semiconductor devices through the first and second interconnect structures and the first ~~conductive vias~~ and second conductive vias.

14. A method of ~~manufacturing~~ making a semiconductor device, comprising:

providing a~~ carrier~~ semiconductor die;

depositing an encapsulant over the semiconductor die;

~~mounting a semiconductor die over the carrier with an active surface of the semiconductor die oriented toward the~~

~~carrier;~~

~~depositing an encapsulant over the semiconductor die and carrier;~~

~~removing the carrier;~~

forming a first interconnect structure over the encapsulant and ~~active surface of the~~ semiconductor die;

forming ~~a plurality of~~ a first conductive via~~s~~ extending continuously through the semiconductor die and into the ~~a portion of the~~ first interconnect structure;

forming a ~~plurality of~~ second conductive via~~s~~ extending through the encapsulant and ~~a portion of~~ into the first interconnect structure; ~~in the same direction as the first vias;~~

~~depositing electrically conductive material in the first vias to form first conductive vias and in the second vias to form second conductive vias;~~ and

forming a second interconnect structure over the encapsulant opposite the first interconnect structure and electrically connected to the first and second conductive vias ~~and second conductive vias~~.

15. The method of claim 14, further including:

planarizing the encapsulant ~~with~~and a ~~back~~ surface of the semiconductor die; and

forming an insulating layer over the semiconductor die and encapsulant.

16. The method of claim 14, ~~further including:~~wherein forming the first conductive via further includes:

forming a first via through the semiconductor die;

depositing an electrically conductive material over a sidewall of the first via; and

disposing an insulating material in the first via over the electrically conductive material.

~~depositing the electrically conductive material over sidewalls of the first vias to form the first conductive vias; and~~

~~forming an insulating material in the first vias over the~~

~~first conductive vias.~~

17. The method of claim 14, further including~~:~~

forming a bump~~s~~ on a contact pad~~s~~ of the semiconductor die prior to ~~mounting~~ disposing the semiconductor die over ~~the~~a carrier~~; and~~

~~mounting the semiconductor die with bumps to the carrier~~.

18. The method of claim 17, further including depositing the encapsulant or an underfill material around the bumps and beneath the semiconductor die.

19. The method of claim 14, further including ~~forming an insulating material over sidewalls of the first vias and second vias prior to depositing the electrically conductive material to form the first conductive vias and second conductive vias~~ disposing an insulating material over a sidewall of the first or second conductive via.

20. The method of claim 14, further including:

stacking a first and second ~~plurality of the~~ semiconductor device~~s~~; and

electrically connecting the first and second ~~stacked~~ semiconductor devices through the first and second interconnect structures and the first ~~conductive vias~~ and second conductive vias.

~~21. A semiconductor device, comprising:~~

~~a semiconductor die;~~

~~an encapsulant deposited over the semiconductor die;~~

~~a first conductive via formed through the semiconductor die;~~

~~a second conductive via formed through the encapsulant in the same direction as the first conductive via;~~

~~a first interconnect structure formed over the encapsulant and electrically connected to the first conductive via and second conductive via; and~~

~~a second interconnect structure formed over the encapsulant opposite the first interconnect structure and electrically~~

~~connected to the first conductive via and second conductive via.~~

~~22. The semiconductor device of claim 21, further including bumps formed on contact pads of the semiconductor die.~~

~~23. The semiconductor device of claim 22, further including underfill material or encapsulant deposited around the bumps beneath the semiconductor die.~~

~~24. The semiconductor device of claim 21, further including an insulating material formed over sidewalls of the first vias and second vias.~~

~~25. The method of claim 21, further including a plurality of stacked semiconductor devices electrically connected through the first and second interconnect structures and first conductive vias and second conductive vias.~~

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

depositing an encapsulant over a semiconductor die;

forming an insulating layer over the semiconductor die;

forming a first conductive via extending continuously through the insulating layer and semiconductor die; and

forming a second conductive via through the encapsulant.

22. The method of claim 21, further including planarizing the encapsulant and a surface of the semiconductor die.

23. The method of claim 21, further including forming a bump on the semiconductor die.

24. The method of claim 21, further including forming a first interconnect structure over the insulating layer.

25. The method of claim 24, further including forming a second interconnect structure opposite the first interconnect structure.