Claims

What is claimed:

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

providing a semiconductor wafer including a plurality of semiconductor die formed within a surface area of the semiconductor wafer;

testing each semiconductor die to confirm as a known good semiconductor die;

singulating the semiconductor die from the semiconductor wafer;

providing a carrier including a surface area larger than the surface area of the semiconductor wafer;

disposing the known good semiconductor die over the carrier to form a reconstituted wafer, wherein a number of the known good semiconductor die disposed side-by-side and non-overlapping over the carrier is greater than the total number of the known good semiconductor die singulated from the semiconductor wafer;

providing a chase mold;

disposing the reconstituted wafer within the chase mold;

closing the chase mold with the known good semiconductor die disposed within a cavity of the chase mold;

dispersing an encapsulant around the known good semiconductor die within the cavity under temperature and pressure;

removing the reconstituted wafer from the chase mold; and

forming an interconnect structure over the reconstituted wafer.

2. The method of claim 1, further including planarizing the encapsulant to expose a surface of the known good semiconductor die.

3. The method of claim 1, wherein the surface area of the carrier is 10-50% greater than the surface area of the semiconductor wafer.

4. The method of claim 1, wherein providing the chase mold includes:

providing an upper mold support including the cavity;

providing a lower mold support with spring-loaded lifter pins;

disposing the reconstituted wafer over the spring-loaded lifter pins;

depositing the encapsulant over the reconstituted wafer;

closing the chase mold to compress the spring-loaded lifter pins which apply pressure to hold the upper mold support and lower mold support against opposing surfaces of the reconstituted wafer with the known good semiconductor die disposed within the cavity; and

dispersing the encapsulant under an elevated temperature around the known good semiconductor die.

5. The method of claim 1, further including:

providing an upper mold support including an inlet and the cavity;

providing a lower mold support with spring-loaded lifter pins;

disposing ~~mounting~~ the reconstituted wafer over the spring-loaded lifter pins;

closing the chase mold to compress the spring-loaded lifter pins which apply pressure to hold the upper mold support and lower mold support against opposing surfaces of the reconstituted wafer with the known good semiconductor die disposed within the cavity; and

injecting the encapsulant under an elevated temperature through the inlet into the cavity around the known good semiconductor die.

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

providing a semiconductor wafer including a plurality of known good semiconductor die formed within a surface area of the semiconductor wafer;

singulating the known good semiconductor die from the semiconductor wafer;

providing a carrier including a surface area larger than the surface area of the semiconductor wafer;

disposing the known good semiconductor die over a surface of the carrier to form a reconstituted wafer, wherein a number of the known good semiconductor die disposed side-by-side and non-overlapping over the carrier is greater than the total number of the known good semiconductor die singulated from the semiconductor wafer;

providing a chase mold including an upper mold support and lower mold support with spring-loaded lifter pins;

disposing the reconstituted wafer within the chase mold over the lower mold support and spring-loaded lifter pins;

closing the chase mold to compress the spring-loaded lifter pins which apply pressure to hold the upper mold support and lower mold support against opposing surfaces of the

reconstituted wafer with the known good semiconductor die disposed within a cavity of the chase mold;

providing an encapsulant around the known good semiconductor die within the cavity under temperature and pressure;

removing the reconstituted wafer from the chase mold; and

forming an interconnect structure over the reconstituted wafer.

7. The method of claim 6, wherein the surface area of the carrier is 10-50% greater than the surface area of the semiconductor wafer.

8. The method of claim 6, further including planarizing the encapsulant to expose a surface of the known good semiconductor die.

~~1~~9. A method of making a semiconductor device, comprising:

providing a semiconductor wafer including a plurality of semiconductor die formed within a surface area of the semiconductor wafer;

testing the semiconductor die to confirm as known good semiconductor die;

singulating the semiconductor die from the semiconductor wafer;

providing a carrier including ~~having~~ a surface area larger than the surface area of the semiconductor wafer; and

disposing ~~mounting~~ the known good semiconductor die ~~to~~over the carrier to form a reconstituted wafer, wherein a number of the known good semiconductor die ~~mounted~~ disposed side-by-side

and non-overlapping over~~to~~ the carrier is greater than ~~a~~the total number of the known good semiconductor die singulated from the semiconductor wafer.

~~2. The method of claim 1, wherein the semiconductor die is a known good semiconductor die.~~

~~3~~10. The method of claim ~~1~~9, wherein the surface area of the carrier is 10-50% greater than the surface area of the semiconductor wafer.

~~4~~11. The method of claim ~~1~~9, further including:

providing a chase mold;

disposing the reconstituted wafer within the chase mold;

closing the chase mold with the known good semiconductor die disposed within a cavity of the chase mold;

dispersing an encapsulant around the known good semiconductor die within the cavity under temperature and pressure;

removing the reconstituted wafer from the chase mold; and

forming an interconnect structure over the reconstituted wafer.

~~5~~12. The method of claim ~~4~~11, wherein providing the chase mold includes:

providing an upper mold support including the cavity;

providing a lower mold support with spring-loaded lifter pins;

~~mounting~~disposing the reconstituted wafer over the spring-loaded lifter pins;

depositing the encapsulant over the reconstituted wafer;

closing the chase mold ~~so that the lower mold support and upper mold support contact the carrier under pressure to enclose the semiconductor die and encapsulant within the cavity of the upper mold support and~~ to compress the spring-loaded lifter pins which apply pressure to hold the upper mold support and lower mold support against opposing surfaces of the reconstituted wafer with the known good semiconductor die disposed within the cavity; and

dispersing the encapsulant under an elevated temperature around the known good semiconductor die.

~~6~~13. The method of claim ~~4~~10, further including:

providing an upper mold support including an inlet and the cavity;

providing a lower mold support with spring-loaded lifter pins;

disposing~~mounting~~ the reconstituted wafer over the spring-loaded lifter pins;

closing the chase mold ~~so that the lower mold support and upper mold support contact the carrier with the semiconductor die disposed within the cavity of the upper mold support and~~to compress the spring-loaded lifter pins which apply pressure to hold the upper mold support and lower mold support against opposing surfaces of the reconstituted wafer with the known good semiconductor die disposed within the cavity; and

injecting the encapsulant under an elevated temperature through the inlet into the cavity around the known good semiconductor die.

~~7~~14. The method of claim ~~4~~10, wherein forming the interconnect structure includes:

forming a first insulating layer over a surface of the reconstituted ~~semiconductor~~ wafer;

forming a conductive layer over the first insulating layer; and

forming a second insulating layer over the first insulating layer and conductive layer.

~~8. A semiconductor device made by a process, comprising:~~

~~providing a semiconductor wafer including a plurality of semiconductor die formed within a surface area of the semiconductor wafer;~~

~~singulating the semiconductor die from the semiconductor wafer;~~

~~providing a carrier having a surface area larger than the surface area of the semiconductor wafer; and~~

~~mounting the semiconductor die to the carrier to form a reconstituted wafer, wherein a number of semiconductor die mounted to the carrier is greater than a number of semiconductor die singulated from the semiconductor wafer.~~

~~9. The semiconductor device of claim 8, wherein the surface area of the carrier is 10 50% greater than the surface area of the semiconductor wafer.~~

~~10. The semiconductor device of claim 8, further including:~~

providing a chase mold;

~~disposing the reconstituted wafer within the chase mold;~~

~~closing the chase mold with the semiconductor die disposed within a cavity of the chase mold;~~

~~dispersing an encapsulant around the semiconductor die within the cavity under temperature and pressure;~~

~~removing the reconstituted wafer from the chase mold; and~~

~~forming an interconnect structure over the reconstituted wafer.~~

1~~1~~5. A method of making a semiconductor device, comprising:

providing a semiconductor wafer including a plurality of semiconductor die formed within a surface area of the semiconductor wafer;

testing the semiconductor die to confirm as known good semiconductor die;

singulating the semiconductor die from the semiconductor wafer;

providing a first carrier;

providing a second carrier including ~~having~~ a surface area ~~larger~~less than a surface area of ~~a second~~ the first carrier; and

~~mounting~~disposing the known good semiconductor die ~~to~~ over the first carrier using a set of manufacturing tools to form a reconstituted wafer, wherein a ~~first~~ number of the known good semiconductor die disposed side-by-side and non-overlapping over ~~mounted to~~ the first carrier is greater than ~~a~~the total ~~second~~ number of the known good semiconductor die singulated from the semiconductor wafer~~that can be mounted to the second carrier smaller than the first carrier using the set of manufacturing tools~~.

~~12. The method of claim 11, wherein the semiconductor die is a known good semiconductor die.~~

16. The method of claim 15, wherein the surface area of the first carrier is 10-50% greater than the surface area of the second carrier.

1~~3~~7. The method of claim 1~~1~~5, further including:

providing a chase mold;

disposing the reconstituted wafer within the chase mold;

closing the chase mold with the known good semiconductor die disposed within a cavity of the chase mold;

dispersing an encapsulant around the known good semiconductor die within the cavity under temperature and pressure;

removing the reconstituted wafer from the chase mold; and

forming an interconnect structure over the reconstituted wafer.

~~14. The method of claim 13, wherein providing the chase mold includes:~~

~~providing an upper mold support including the cavity;~~

~~providing a lower mold support with spring loaded lifter pins;~~

~~mounting the reconstituted wafer over the spring-loaded lifter pins;~~

~~depositing the encapsulant over the reconstituted wafer;~~

~~closing the chase mold so that the lower mold support and upper mold support contact the carrier under pressure to enclose the semiconductor die and encapsulant within the cavity of the upper mold support and compress the spring loaded lifter pins; and~~

~~dispersing the encapsulant under an elevated temperature around the semiconductor die.~~

~~15. The method of claim 13, further including:~~

~~providing an upper mold support including an inlet and the cavity;~~

~~providing a lower mold support with spring-loaded lifter pins;~~

~~mounting the reconstituted wafer over the spring-loaded lifter pins;~~

~~closing the chase mold so that the lower mold support and upper mold support contact the carrier with the semiconductor die disposed within the cavity of the upper mold support and compress the spring-loaded lifter pins; and~~

~~injecting the encapsulant under an elevated temperature through the inlet into the cavity around the semiconductor die.~~

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

providing a semiconductor wafer including a plurality of semiconductor die;

testing the semiconductor die to confirm as known good semiconductor die;

singulating the semiconductor die from the semiconductor wafer;

providing a carrier; and

disposing the known good semiconductor die over a surface of the carrier to form a reconstituted wafer, wherein a number of the known good semiconductor die disposed side-by-side and non-overlapping over the carrier is greater than the total number of the semiconductor die singulated from the semiconductor wafer.

19. The method of claim 18, wherein a surface area of the carrier is 10-50% greater than a surface area of the semiconductor wafer.

20. The method of claim 18, further including planarizing the encapsulant to expose a surface of the known good semiconductor die.

21. The method of claim 18, further including forming an interconnect structure over the reconstituted wafer.

22. The method of claim 21, wherein forming the interconnect structure includes:

forming a first insulating layer over a surface of the reconstituted wafer;

forming a conductive layer over the first insulating layer; and

forming a second insulating layer over the first insulating layer and conductive layer.