FACE MOUNTED DEVICE ON SMALL MOUNT PAD

FIELD OF THE INVENTION

This invention relates to semiconductor devices, and more particularly to a semiconductor device utilizing Lead-On-Chip (LOC) technology with the semiconductor die face mounted on a Small Mount Pad (SMP) lead frame.

BACKGROUND OF THE INVENTION

The lead frames for semiconductor devices can take may forms. Presently one design utilizes crossed tie bars to form a mounting area for the semiconductor die. The semiconductor die is then attached to the area where the tie bars cross forming a die mounting pad. Devices with small mount pads are referred to as SMP lead frames, or Small Mount Pad lead frame. U.S. Patent 5,424,576, illustrates a lead frame with a die mount area formed by crossed tie bars. The semiconductor die is attached to the crossed tie

bars with an adhesive which may be applied as a liquid or may be an adhesive tape. After the die is attached to the lead frame, the die attach material usually has to be cured providing a longer manufacturing cycle time. U.S. Patent also shows a plastic encapsulation around the lead frame and mounted semiconductor die. It should be noted that most of the back side of the semiconductor die which is attached to the crossed tie bars is covered so that very little of the back side of the semiconductor die will be in contact with the plastic encapsulant. Generally, the more of the back side of the semiconductor die in contact with the encapsulant, the less likely there will be delamination between the semiconductor die and the encapsulant, thereby improving package integrity.

SUMMARY OF THE INVENTION

The invention is package that includes a Lead-On-Chip (LOC) type lead frame that has a small die mount pad. The active or circuit side semiconductor die is attached to the under side of the die mount pad with an adhesive, letting the entire back side of the semiconductor die)contact the encapsulating material to provide better adhesion. The package uses an existing LOC lead frame, but uses less adhesive tape for attaching the die to the die mount pad because of the center mounting of the semiconductor on the small

die mount pad. The small attach area on the face of the semiconductor, and the unattached back side of the semiconductor die provided a greater area for the mold compound to semiconductor chip contact, providing greater adhesion strength as compared to mold compound to lead frame adhesion strength.

BRIEF DESCRIPTIONS OF THE DRAWINGS

FIG. 1 shows a top view of a prior art lead frame with the semiconductor die attached to the crossed tie bars;

FIG. 2 is a side view of the prior art lead frame of FIG. 1;

FIG. 3 is a top view of a device according to the present invention;

FIG. 4 is a side view of the device of FIG. 3; and

FIG. 5 is a cross-sectional view of the device of FIG. 3, taken through section 5-5.

DESCRIPTION OF A PREFERRED EMBODIMENT

FIG. 1 shows a prior art Small Mount Pad (SMP) lead frame having crossed tie bars 15 presenting an "X" frame 17 on which semiconductor die 14 is mounted. Leads 11 around the periphery of semiconductor die 14 are connected to contacts 13 arrayed around die 14 by bond wires 12. The outline of the package is shown in dashed lines 18.

FIG. 2 is a cross-sectional view of the device illustrated in FIG. 1 taken through section 2-2. Semiconductor die 14 is bonded to tie bars 15 with an adhesive 20. Lead 11 is shown attached to contact 13 by bond wire 12. The outline of the package is shown by dashed line 18.

FIG. 3 shows a semiconductor device 30 according to the present invention. Tie bars 31 form an "X" at their intersection and are down set at 31a place the outer ends of tie bars 31 and lead 34 on a plane lower than the circular small die mount pad 32 formed at the intersection of tie bars 31. Leads 34 are connected to respective contacts 35 on the surface of semiconductor die 33. Semiconductor die 33 is attached at its face surface to die mount pad 32 by an adhesive material or adhesive tape 37, show by a dashed line. This is distinct from the prior art in that the semiconductor die is attached by it backside to the die mount pad.

FIG. 4 is a side view of the device 30 of FIG. 3 showing semiconductor die attached to die mount pad 32 by adhesive 37. The down set 31a in each of tie bar 31 shows that the down set effective lowers the contact ends of leads 34.

FIG. 5 shows a cross-sectional view taken through section 5-5 of FIG. 3. Tie bars 31 have been cut to show the bond wires 36 connecting contacts 35 to leads 34. Adhesive 37 bonds the face of semiconductor die 33 to the bottom side of die pad 32. The package out line is shown by dashed lines 18.

The use of the LOC header with the SMP reduces the stress that the lead frame will have on the passivation layers (not illustrated) on the face of semiconductor device 33. The bare underside 33a of semiconductor die 33 has direct contact with the package encapsulant 18 decreasing backside delaminating of the encapsulant from the back of die 33.

A pretaped lead frame may be used so that die 33 is attached to and held below the lead frame. The attached area is at the center of die 33, and not at the edge of the die common in prior art mounting techniques.

Also, the small attach area on the face of the semiconductor, and the unattached back side of the semiconductor die provided a greater area for the mold compound to semiconductor chip contact, providing greater adhesion strength as compared to mold compound to lead frame adhesion strength.

WHAT IS CLAIMED

1. A semiconductor device package, comprising:

a lead frame having a plurality of lead frame leads and a die mount pad;

a semiconductor die having a circuit side and a back side, the circuit side attached to the die mount pad;

a plurality of bond wires attaching the lead frame leads to the semiconductor die; and

an encapsulating material enclosing the semiconductor die and a portion of the lead frame leads.

2. The semiconductor device package according to claim 1, wherein said semiconductor die is attached to the die mount pad by an adhesive.

3. The semiconductor device package according to claim 1, wherein said semiconductor die is attached to the die mount pad by an adhesive tape.

4. The semiconductor device package according to claim 1, wherein said die pad has a surface area less that the semiconductor die to which it is attached.

5. The semiconductor device package according to claim 1, wherein said encapsulating material attached to the entire back side of the semiconductor die.



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

forming a lead fame with a die mount pad and lead frame leads;

attaching a semiconductor die having a circuit face side and a back side, face side to the die mount pad;

attaching the lead frame leads to the semiconductor die; and

encapsulating the semiconductor die, the die mount pad, and a portion of the lead frame leads.

7. The method according to claim 6, including the steps of attaching the semiconductor die circuit side to the die mount pad using an adhesive.

8. The method according to claim 6, wherein the semiconductor die is attached under the die mount pad.

