CLAIMS

1. An optical package comprising:

a back side routing layer including a top side and bottom side;

a printed circuit board (PCB) core on the top side of the back side routing layer, the PCB core including a plurality of vertical vias and a cavity;

a controller chip face-up within the cavity;

a molding compound encapsulating the controller chip within the cavity;

a front side routing layer on top of the controller chip, the molding compound, and the PCB core; and

a photodetector (PD) mounted on a top side of the front side routing layer.

2. The optical package of claim 1, further comprising an emitter mounted on the top side of the front side routing layer.

3. The optical package of claim 2, wherein the PD includes a bottom electrode directly over a first contact pad of the front side routing layer, and a top electrode wire bonded to a second contact pad of the front side routing layer.

4. The optical package of claim 2, wherein the PD is encapsulated in a first transparent molding compound, and the emitter is encapsulated in a second transparent molding compound, separate from the first transparent molding compound.

5. The optical package of claim 4, further comprising a metal lid on the front side routing layer and surrounding the PD and the emitter.

6. The optical package of claim 4, further comprising an opaque molding compound on the front side routing layer and surrounding the PD and the emitter.

7. The optical package of claim 2, further comprising a plurality of solder bumps on the bottom side of the back side routing layer.

8. The optical package of claim 2, wherein the PCB core comprises a laminate body.

9. The optical package of claim 1, wherein the front side routing layer is a front redistribution layer (RDL) comprising one or more metal traces and one or more dielectric layers.

10. The optical package of claim 1, wherein the back side routing layer is a redistribution layer (RDL) comprising the molding compound and a plurality of through vias through the molding compound.

11. An optical package comprising:

a back side routing layer including a top side and bottom side;

a printed circuit board (PCB) core on the top side of the back side routing layer, the PCB core including a plurality of vertical vias and a plurality of cavities;

a controller chip face-up within a first cavity of the plurality of cavities;

a photodetector (PD) within a second cavity of the plurality of cavities;

a molding compound encapsulating the controller chip within the first cavity and the PD within the second cavity;

a front side routing layer on top of the controller chip, the molding compound, the PCB core; and

an aperture within the front side routing layer over the PD.

12. The optical package of claim 11, further comprising an emitter within a third cavity of the plurality of cavities, and a second aperture within the front side routing layer over the emitter.

13. The optical package of claim 12, further comprising a plurality of solder bumps on the bottom side of the back side routing layer.

14. The optical package of claim 12, wherein the PCB core comprises a laminate body.

15. The optical package of claim 12, wherein the front side routing layer includes a first contact pad on a top electrode of the PD, and the PD comprises a bottom electrode electrically connected to the back side routing layer.

16. The optical package of claim 15, further comprising a via extending through a portion of the molding compound to electrically connect the bottom electrode of the PD to the back side routing layer.

17. The optical package of claim 11, wherein the front side routing layer is a front redistribution layer (RDL) comprising one or more metal traces and one or more dielectric layers.

18. The optical package of claim 11, wherein the back side routing layer is a redistribution layer (RDL) comprising the molding compound and a plurality of through vias through the molding compound.

19. An optical package comprising:

a first package level comprising:

a back side routing layer including a top side and bottom side;

a controller chip on the back side routing layer;

a front side routing layer on top of the controller chip; and

a first plurality of vertical vias extending between the front side routing layer and the back side routing layer;

a second package level comprising:

a photodetector (PD) mounted on and in electrical contact with the front side routing layer;

an emitter mounted on and in electrical contact with the front side routing layer;

a top side routing layer on an in electrical contact with the PD and the emitter; and

a second plurality of vertical vias extending between the top side routing layer and the front side routing layer.

20. The optical package of claim 19, wherein the controller chip is face-up on the back side routing layer.

21. The optical package of claim 20:

wherein the first package level further comprises a printed circuit board (PCB) core on the top side of the back side routing layer, the PCB core including the first plurality of vertical vias and a cavity; and

wherein the controller chip face-up within the cavity.

22. The optical package of claim 21:

wherein the second package level further comprises a second PCB core on the front routing layer, the second PCB core including the second plurality of vertical vias and a plurality of cavities; and

wherein the PD is within a first cavity of the plurality of cavities, and the emitter is within a second cavity of the plurality of cavities.

23. The optical package of claim 22, wherein the second package level is hybrid bonded to the first package level with a plurality of oxide-oxide bonds and metal-metal bonds.

24. The optical package of claim 22, wherein the second package level is solder bonded to the first package level.

25. The optical package of claim 21, wherein the PD, the emitter, and the second plurality of vertical vias are encapsulated in a molding compound.

26. The optical package of claim 25, wherein the top side routing layer is a top redistribution layer (RDL) comprising one or more metal traces and one or more dielectric layers.

27. The optical package of claim 25:

wherein the molding compound is a laser direct structuring (LDS) compatible material including a dispersed non-conductive metal organic compound; and

wherein the top side routing layer comprises trace routing, the trace routing including a nucleation layer of metal particles of the metal in the dispersed non-conductive metal organic compound.

28. The optical package of claim 27, wherein the second plurality of vertical vias include the nucleation layer of metal particles of the metal in the dispersed non-conductive metal organic compound.

29. The optical package of claim 19:

wherein the PD, the emitter, and the second plurality of vertical vias are encapsulated in a second level molding compound;

wherein the second level molding compound is a laser direct structuring (LDS) compatible material including a dispersed non-conductive metal organic compound.

30. The optical package of claim 29:

wherein the first package level further comprises a printed circuit board (PCB) core on the top side of the back side routing layer, the PCB core including the first plurality of vertical vias and a cavity; and

wherein the controller chip is face-up within the cavity.

31. The optical package of claim 29, wherein the controller chip is face-down on the back side routing layer.

32. The optical package of claim 31:

wherein the controller chip is encapsulated in a first level molding compound;

wherein the first level molding compound is a laser direct structuring (LDS) compatible material including a first dispersed non-conductive metal organic compound; and

wherein the front side routing layer comprises a first trace routing, the first trace routing including a first nucleation layer of first metal particles of a first metal in the first dispersed non-conductive metal organic compound.

33. The optical package of claim 32, wherein the back side routing layer is a printed circuit board (PCB).

34. The optical package of claim 32, wherein the back side routing layer is a redistribution layer (RDL) comprising a molding compound and a plurality of through vias through the molding compound.

35. An optical package comprising:

a back side routing layer including a top side and bottom side;

a controller chip mounted face-down on the back side routing layer;

a photodetector (PD) attached to the controller chip, and wire bonded to the back side routing layer;

an emitter attached to the controller chip, and wire bonded to the back side routing layer;

a molding compound encapsulating the controller chip, the PD and the emitter on the back side routing layer.

36. The optical package of claim 35, wherein the molding compound is opaque.