CLAIMS

What is claimed is:

1. A device comprising:

a hybridized device having a top surface and a bottom surface;

a packaging substrate comprising a metal slug in an opening on a light-emitting top surface of the packaging substrate, the metal slug thermally coupled to the bottom surface of the hybridized device;

a plurality of conductive contacts on the light-emitting top surface of the packaging substrate, the plurality of conductive contacts on the light-emitting top surface of the packaging substrate being interfaces to an external control board; and

a plurality of conductive connectors electrically coupled between the top surface of the hybridized device and the light-emitting top surface of the packaging substrate; and wherein the device further comprising at least one metallization layer on the top surface of the packaging substrate electrically coupled between the plurality of conductive connectors and the plurality of conductive contacts.

2. The device of claim 1, wherein the hybridized device comprises a silicon backplane and a monolithic array on the silicon backplane, the monolithic array comprising a plurality of light-emitting segments.

3. The device of claim 2, wherein the silicon backplane comprises a plurality of drivers, one of the plurality of drivers being electrically coupled to provide a drive current to one or a subset of the plurality of light-emitting segments.

4. The device of claim 2, wherein the plurality of light-emitting segments comprises at least 20,000 light-emitting segments spaced 20 μm or less apart.

5. The device of claim 1, further comprising a layer of a thermally conductive metal material between a top surface of the metal slug and the bottom surface of the hybridized device.

6. The device of claim 1, wherein the metal slug comprises a single body of a copper material embedded in the packaging substrate.

7. The device of claim 1, further comprising a light-blocking encapsulant covering the plurality of conductive connectors.

8. The device of claim 7, wherein the light-blocking encapsulant is one of silicone or epoxy with a carbon filler.

9. A device comprising:

a heat sink having a top surface;

a control board having a top surface and a bottom surface and defining an opening, the bottom surface of the control board being thermally coupled to the top surface of the heat sink;

a light-emitting device package at least partially in the opening in the control board, the light-emitting device package comprising a hybridized device on a light-emitting top surface of a packaging substrate, a metal slug in an opening on the light-emitting top surface of the packaging substrate, and a plurality of conductive contacts on the light-emitting top surface of the packaging substrate, a bottom surface of the packaging substrate being thermally coupled to the top surface of the heat sink; ~~and~~

a plurality of conductive connectors electrically coupled between the top surface of the control board and the plurality of conductive contacts on the light-emitting top surface of the packaging substrate; and wherein the device further comprising at least one metallization layer on the top surface of the packaging substrate electrically coupled between the plurality of conductive connectors and the plurality of conductive contacts.

10. The device of claim 9, wherein:

the heat sink further comprises a metal inlay in an opening on a top surface of the heat sink, and

a bottom surface of the metal slug is thermally coupled to a top surface of the metal inlay.

11. The device of claim 9, wherein the plurality of conductive connectors are one of wires, ribbon wires and flexible circuits.

12. The device of claim 9, wherein the hybridized device comprises a silicon backplane and at least one monolithic array on the silicon backplane, the at least one monolithic array comprising 20,000 or more light-emitting segments spaced 20 μm or less apart, and the silicon backplane comprising a separate driver for each of the 20,000 or more light-emitting segments or for each of a subset of the 20,000 or more light-emitting segments.

13. The device of claim 9, wherein the light-emitting package further comprises a plurality of other conductive connectors electrically coupled between a top surface of the hybridized device and the packaging substrate.

14. A device comprising:

a control board having a top surface and a bottom surface;

a light-emitting device package having a bottom surface on the top surface of the control board, the light-emitting device package comprising a hybridized device on a light-emitting top surface of a packaging substrate, a metal slug in an opening on the light-emitting top surface of the packaging substrate, and a plurality of conductive contacts on the light-emitting top surface of the packaging substrate; and

a plurality of conductive connectors electrically coupled between the top surface of the control board and the plurality of conductive contacts on the light-emitting top surface of the packaging substrate; and wherein the device further comprising at least one metallization layer on the top surface of the packaging substrate electrically coupled between the plurality of conductive connectors and the plurality of conductive contacts.

15. The device of claim 14, wherein:

the control board further comprises a metal inlay in an opening on the top surface of the control board, and

a bottom surface of the metal slug is thermally coupled to a top surface of the metal inlay.

16. The device of claim 14, wherein the plurality of conductive connectors are one of wires, ribbon wires and flexible circuits.

17. The device of claim 14, wherein the hybridized device comprises a silicon backplane and at least one monolithic array on the silicon backplane, the at least one monolithic array comprising 20,000 or more light-emitting segments spaced 20 μm or less apart, and the silicon backplane comprising a separate driver for each of the 20,000 or more light-emitting segments or for each of a subset of the 20,000 or more light-emitting segments.

18. The device of claim 14, wherein the light-emitting package further comprises a plurality of other conductive connectors electrically coupled between a top surface of the hybridized device and the packaging substrate.