CLAIMS

What is claimed is:

1. An electronic apparatus, comprising:

a package substrate having alternating metallization layers and dielectric layers, the package substrate comprising:

a first plurality of substrate pads and a second plurality of substrate pads; and

an open cavity between the first plurality of substrate pads and the second plurality of substrate pads, the open cavity having a bottom and sides;

a bridge die in the open cavity, the bridge die comprising a first plurality of bridge pads, a second plurality of bridge pads, a power delivery bridge pad between the first plurality of bridge pads and the second plurality of bridge pads, and conductive traces;

a first die coupled to the first plurality of substrate pads and the first plurality of bridge pads;

a second die coupled to the second plurality of substrate pads and the second plurality of bridge pads, the second die coupled to the first die by the conductive traces of the bridge die; and

a power delivery conductive line coupled to the power delivery bridge pad.

2. The electronic apparatus of claim 1, further comprising;

an underfill material between the first die and the package substrate, between the first die and the bridge die, between the second die and the package substrate, between the second die and the bridge die, and in the open cavity.

3. The electronic apparatus of claim 2, further comprising:

a trench in the underfill material between the first die and the second die, wherein the power delivery conductive line is in the trench.

4. The electronic apparatus of claim 1, wherein the package substrate further comprises a substrate pad outside of a footprint of the first die and the second die, wherein the power delivery conductive line is coupled to the substrate pad outside of the footprint of the first die and the second die.

5. The electronic apparatus of claim 1, further comprising:

solder structures coupling the bridge die to the bottom of the open cavity.

6. The electronic apparatus of claim 5, wherein the bottom of the cavity has an exposed metal layer, wherein the bridge die has a first side comprising the first plurality of bridge pads, the second plurality of bridge pads, the power delivery bridge pad, and the conductive traces, and the bridge die having a second side comprising a metallization layer, and wherein the solder structures in contact with the metallization layer of the bridge die and in contact with the exposed metal layer of the bottom of the open cavity.

7. The electronic apparatus of claim 1, further comprising:

an adhesive layer coupling the bridge die to the bottom of the open cavity.

8. The electronic apparatus of claim 1, wherein the first die is coupled to the first plurality of substrate pads and the first plurality of bridge pads by a first plurality of solder structures, and the second die is coupled to the second plurality of substrate pads and the second plurality of bridge pads by a second plurality of solder structures.

9. The electronic apparatus of claim 1, further comprising:

a board coupled to a side of the package substrate opposite the first die and the second die.

10. The electronic apparatus of claim 1, wherein adjacent pads of the first plurality of bridge pads and adjacent pads of the second plurality of bridge pads have a first pitch, and wherein adjacent pads of the first plurality of substrate pads and adjacent pads of the second plurality of substrate pads have a second pitch greater than the first pitch.

11. The electronic apparatus of claim 10, wherein the first pitch is less than 100μm and the second pitch is greater than 100μm.

12. An electronic apparatus, comprising:

a package substrate having alternating metallization layers and dielectric

layers, the package substrate comprising:

a first plurality of substrate pads and a second plurality of substrate pads; and

an open cavity between the first plurality of substrate pads and the second plurality of substrate pads, the open cavity having a bottom and sides;

a bridge die in the open cavity, the bridge die comprising a first plurality of bridge pads, a second plurality of bridge pads, a plurality of power delivery bridge pads between the first plurality of bridge pads and the second plurality of bridge pads, and conductive traces;

a plurality of bridge solder structures coupled to corresponding ones of the plurality of power delivery bridge pads;

a first die coupled to the first plurality of substrate pads and the first plurality of bridge pads;

a second die coupled to the second plurality of substrate pads and the second plurality of bridge pads, the second die coupled to the first die by the conductive traces of the bridge die; and

a power delivery conductive line coupled to the plurality of solder structures.

13. The electronic apparatus of claim 12, wherein the package substrate further comprises a plurality of substrate pads between the first die and the second die, and a plurality of substrate solder structures coupled to corresponding ones of the

plurality of substrate pads, wherein the power delivery conductive line is coupled to the plurality of substrate solder structures.

14. The electronic apparatus of claim 12, further comprising: an underfill material between the first die and the package substrate, between the first die and the bridge die, between the second die and the package substrate, between the second die and the bridge die, and in the open cavity

15. The electronic apparatus of claim 12, further comprising:

solder structures coupling the bridge die to the bottom of the open cavity.

16. The electronic apparatus of claim 15, wherein the bottom of the cavity has an exposed metal layer, wherein the bridge die has a first side comprising the first plurality of bridge pads, the second plurality of bridge pads, the power delivery bridge pad, and the conductive traces, and the bridge die having a second side comprising a metallization layer, and wherein the solder structures in contact with the metallization layer of the bridge die and in contact with the exposed metal layer of the bottom of the open cavity.

17. The electronic apparatus of claim 12, further comprising:

an adhesive layer coupling the bridge die to the bottom of the open cavity.

18. The electronic apparatus of claim 12, wherein the first die is coupled to the first plurality of substrate pads and the first plurality of bridge pads by a first plurality

of solder structures, and the second die is coupled to the second plurality of substrate pads and the second plurality of bridge pads by a second plurality of solder structures.

19. The electronic apparatus of claim 12, further comprising:

> a board coupled to a side of the package substrate opposite the first die

and the second die.

20. The electronic apparatus of claim 12, wherein adjacent pads of the first plurality of bridge pads and adjacent pads of the second plurality of bridge pads have a first pitch, and wherein adjacent pads of the first plurality of substrate pads and adjacent pads of the second plurality of substrate pads have a second pitch greater than the first pitch.

21. The electronic apparatus of claim 20, wherein the first pitch is less than 100µm and the second pitch is greater than 100µm.