

CLAIMS

What is claimed is:

1. A device package, comprising:
 - 5 a dielectric on a conductive pad;
a first via on a first seed, the first seed on a top surface of the conductive pad, wherein the first via extends through the dielectric;
a conductive trace on the dielectric; and
a second via on a second seed layer, the second seed is on the dielectric, wherein the
10 conductive trace connects to the first via and the second via, wherein the second via connects to an edge of the conductive trace that is opposite from the first via.
2. The device package of claim 1, further comprising a seed on the dielectric prior to the conductive trace on the dielectric, wherein the seed electrically couples to the conductive trace.
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3. The device package of claim 1, wherein the conductive trace electrically couples to the first via and the second via.
4. The device package of claim 1, further comprising a second dielectric on the dielectric,
20 the conductive trace, and the first and second vias, wherein the second dielectric exposes a top surface of the second via.
5. The device package of claim 1, wherein the dielectric includes a photoimageable dielectric
25 film or a buildup film.
6. The device package of claim 2, prior to the formation of the conductive trace, the first via, and the second via, further comprising:
 - a selective resist on the seed, wherein the selective resist includes a positive-tone dry film
30 resist material; and
a mask with one or more intensity regions, wherein the mask prints one or more dose regions on the selective resist based on the one or more intensity regions of the mask.
7. The device package of claim 6, wherein the one or more dose regions on the selective
35 resist have one or more different development times that pattern the selective resist for the

conductive trace and the first and second vias.

8. The device package of claim 7, wherein the one or more different development times of the selective resist include a first development time on a first dose region, a second development
5 time on a second dose region, and a third development time on a third dose region.

9. The device package of claim 8, wherein the first dose region is patterned to form the first via, the second dose region is patterned to form the second via, and the third dose region is patterned to form the conductive trace.
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10. The device package of claim 1, wherein the conductive trace, the first via, and the second via are electrolytically plated.

11. The device package of claim 1, wherein the conductive pad is on a transparent substrate.
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12. The device package of claim 11, wherein the transparent substrate includes a glass carrier, a polyethylene terephthalate (PET), a dielectric film, a polydimethylsiloxane (PDMS), an organic transparent material, or one or more transparent materials.

20 13. The device package of claim 1, wherein the conductive trace has a line density that is substantially equal to a line density of the first via and a line density of the second via.

14. The device package of claim 2, prior to the formation of the conductive trace, the first via, and the second via, further comprising a first selective resist and a second selective resist on
25 the seed, wherein the second selective resist is on the first selective resist, wherein the first and second selective resist include negative-tone dry resist materials.

15. The device package of claim 14, wherein the stacked first and second selective resists are patterned to form one or more openings on the seed, and wherein a third resist is deposited on
30 the one or more openings and the second selective resist.

16. The device package of claim 15, wherein the second selective resist and the third resist are removed and patterned to form one or more via openings for the first and second vias.

35 17. The device package of claim 11, wherein the conductive pad on the transparent substrate

is transferred and electrically coupled to a second substrate.

18. A method of forming a device package, comprising:
disposing a dielectric on a conductive pad;
5 disposing a first via on a first seed, the first seed on a top surface of the conductive pad,
wherein the first via extends through the dielectric;
disposing a conductive trace on the dielectric; and
disposing a second via on a second seed layer, the second seed is on the dielectric,
wherein the conductive trace connects to the first via and the second via, wherein the second via
10 connects to an edge of the conductive trace that is opposite from the first via.
19. The method of claim 18, further comprising disposing a seed on the dielectric prior to the
conductive trace on the dielectric, wherein the seed electrically couples to the conductive trace.
- 15 20. The method of claim 18, wherein the conductive trace electrically couples to the first via
and the second via.
21. The method of claim 18, further comprising disposing a second dielectric on the
dielectric, the conductive trace, and the first and second vias, wherein the second dielectric
20 exposes a top surface of the second via.
22. The method of claim 18, wherein the dielectric includes a photoimageable dielectric
film or a buildup film.
- 25 23. The method of claim 19, prior to the formation of the conductive trace, the first via, and
the second via, further comprising:
disposing a selective resist on the seed, wherein the selective resist includes a positive-
tone dry film resist material; and
exposing a mask with one or more intensity regions on the selective resist, wherein the
30 mask prints one or more dose regions on the selective resist based on the one or more intensity
regions of the mask.
24. The method of claim 23, wherein the one or more dose regions on the selective resist
have one or more different development times that pattern the selective resist for the conductive
35 trace and the first and second vias.

25. The method of claim 24, wherein the one or more different development times of the selective resist include a first development time on a first dose region, a second development time on a second dose region, and a third development time on a third dose region.

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26. The method of claim 25, wherein the first dose region is patterned to form the first via, the second dose region is patterned to form the second via, and the third dose region is patterned to form the conductive trace.

10 27. The method of claim 18, wherein the conductive trace, the first via, and the second via are electrolytically plated.

28. The method of claim 18, wherein the conductive pad is on a transparent substrate.

15 29. The method of claim 28, wherein the transparent substrate includes a glass carrier, a PET, a dielectric film, a PDMS, an organic transparent material, or one or more transparent materials.

30. The method of claim 18, wherein the conductive trace has a line density that is substantially equal to a line density of the first via and a line density of the second via.

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31. The method of claim 19, prior to the formation of the conductive trace, the first via, and the second via, further comprising disposing a first selective resist and a second selective resist on the seed, wherein the second selective resist is on the first selective resist, wherein the first and second selective resist include negative-tone dry resist materials.

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32. The method of claim 31, wherein the stacked first and second selective resists are patterned to form one or more openings on the seed, and wherein a third resist is deposited on the one or more openings and the second selective resist.

30 33. The method of claim 32, wherein the second selective resist and the third resist are removed and patterned to form one or more via openings for the first and second vias.

34. The method of claim 28, wherein the conductive pad on the transparent substrate is transferred and electrically coupled to a second substrate.

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35. A device package, comprising:
a dielectric on a conductive pad;
a first via on a first seed, the first seed on a top surface of the conductive pad, wherein the first via extends through the dielectric;
5 a conductive trace on the dielectric;
a second via on a second seed layer, the second seed is on the dielectric, wherein the conductive trace connects to the first via and the second via, wherein the second via connects to an edge of the conductive trace that is opposite from the first via;
a die on a first-level interconnect (FLI) pad, wherein the FLI pad connects to the second
10 via; and
an interconnect package layer on a second-level interconnect (SLI) pad, wherein the SLI pad connects to the first via.
36. The device package of claim 35, further comprising one or more conductive traces
15 having one or more first vias and one or more second vias, and the interconnect package layer having one or more interconnect package layers stacked on each other, wherein the one or more package layers connect to the one or more conductive traces, first vias, and second vias.
37. The device package of claim 35, further comprising a seed on the dielectric prior to the
20 conductive trace on the dielectric, wherein the seed electrically couples to the conductive trace.
38. The device package of claim 35, wherein the conductive trace electrically couples to the first via and the second via.
- 25 39. The device package of claim 35, further comprising a second dielectric on the dielectric, the conductive trace, and the first and second vias, wherein the second dielectric exposes a top surface of the second via.
40. The device package of claim 35, wherein the dielectric includes a photoimageable
30 dielectric film or a buildup film.
41. The device package of claim 37, prior to the formation of the conductive trace, the first via, and the second via, further comprising:
35 a selective resist on the seed, wherein the selective resist includes a positive-tone dry film

resist material; and

a mask with one or more intensity regions, wherein the mask prints one or more dose regions on the selective resist based on the one or more intensity regions of the mask.

5 42. The device package of claim 41, wherein the one or more dose regions on the selective resist have one or more different development times that pattern the selective resist for the conductive trace and the first and second vias.

10 43. The device package of claim 42, wherein the one or more different development times of the selective resist include a first development time on a first dose region, a second development time on a second dose region, and a third development time on a third dose region.

15 44. The device package of claim 43, wherein the first dose region is patterned to form the first via, the second dose region is patterned to form the second via, and the third dose region is patterned to form the conductive trace.

20 45. The device package of claim 35, wherein the conductive trace, the first via, and the second via are electrolytically plated.

46. The device package of claim 35, wherein the conductive pad is on a transparent substrate.

25 47. The device package of claim 46, wherein the transparent substrate includes a glass carrier, a PET, a dielectric film, a PDMS, an organic transparent material, or one or more transparent materials.

30 48. The device package of claim 35, wherein the conductive trace has a line density that is substantially equal to a line density of the first via and a line density of the second via.

49. The device package of claim 37, prior to the formation of the conductive trace, the first via, and the second via, further comprising a first selective resist and a second selective resist on the seed, wherein the second selective resist is on the first selective resist, wherein the first and second selective resist include negative-tone dry resist materials.

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50. The device package of claim 49, wherein the stacked first and second selective resists are patterned to form one or more openings on the seed, and wherein a third resist is deposited on the one or more openings and the second selective resist.
- 5 51. The device package of claim 50, wherein the second selective resist and the third resist are removed and patterned to form one or more via openings for the first and second vias.
52. The device package of claim 46, wherein the conductive pad on the transparent substrate is transferred and electrically coupled to a second substrate.