

CLAIMS:

1. An integrated circuit (IC) assembly comprising:
an IC substrate having one or more micro-devices;
at least one dielectric matrix element placed on said IC substrate over at least
5 one of its one or more micro-devices; and
an encapsulation element applied over said IC substrate and said at least one
dielectric matrix element placed thereon to enclose and seal said IC substrate.
2. The assembly of claim 1 comprising at least one spacer element placed on the at
least one dielectric matrix element for partitioning between said at least one dielectric
10 matrix element and the encapsulation element.
3. The assembly of claim 2 wherein the at least one spacer element is a detachable
element removed from an aligning element configured to accurately place the at least
one dielectric matrix element on the IC substrate.
4. The assembly of any one of claims 2 and 3 wherein the at least one spacer
15 element is a sheet of electrically insulating material having thickness in a range of 0.1 to
0.3 millimeters.
5. The assembly of any one of the preceding claims wherein the at least one
dielectric matrix element is made of a thin film or foil.
6. The assembly of any one of the preceding claims wherein the at least one
20 dielectric matrix element is made from a breathable material.
7. The assembly of any one of the preceding claims wherein the at least one
dielectric matrix element is made from a permeable material.
8. The assembly of any one of the preceding claims wherein the at least one
dielectric matrix element is made of a cellular material.
- 25 9. The assembly of any one of the preceding claims wherein the at least one
dielectric matrix element is made of a fibrous material.
10. The assembly of any one of the preceding claims wherein the at least one
dielectric matrix element comprises a plurality of loop, hook, and/or bristle elements.

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11. The assembly of any one of the preceding claims wherein the encapsulation element comprises plastic or resin mold.
12. The assembly of any one of the preceding claims comprising a circuit board electrically coupled to the IC substrate and its one or more micro-devices.
- 5 13. The assembly of claim 12 comprising one or more electrical conductors electrically coupled to the circuit board and extending through the encapsulation element to provide electrical connectivity to said circuit board.
14. A multilayered circuit structure comprising at least one IC assembly of claim 12 and at least one additional circuit board having one or more devices and/or ICs attached
10 thereto, said at least one additional circuit board is attached and electrically coupled to said at least one IC assembly to form a stack structure.
15. The multilayered circuit structure of claim 14 comprising one or more electrical conductors electrically extending through the encapsulation element to provide electrical connectivity between the at least one IC assembly and the at least one
15 additional circuit board.
16. The multilayered circuit structure of claim 15 comprising at least one via formed in the at least one additional circuit board for establishing electrical connectivity with at least one of the one or more electrical conductors.
17. A method of encapsulating an integrated circuit comprising one or more micro-
20 devices, the method comprising placing at least one dielectric matrix element on said IC substrate over at least one of its one or more micro-devices and applying an encapsulation mold over said IC substrate and said at least one dielectric matrix element placed thereon to enclose and seal said IC substrate.
18. The method of claim 17 comprising placing the at least one dielectric matrix
25 element with a spacer element thereon.
19. The method of any one of claims 17 and 18 comprising adhering the at least one dielectric matrix element to the IC substrate.
20. The method of claim 17 wherein the placing of the at least one dielectric matrix element comprises attaching the at least one dielectric matrix element to a carrier
30 element configured to facilitate accurate placement of the at least one dielectric matrix element on the IC substrate.

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21. The method of claim 20 comprising removing the carrier element before applying the encapsulation coat.
22. The method of claim 21 wherein the removing of the carrier element comprises detaching at least one portion of the carrier element located on said at least one
5 dielectric matrix element.
23. A method of constructing a multilayered circuit structure comprising attaching at least one circuit board on top of the IC encapsulated using the method of any one of claims 17 to 22, and electrically coupling said at least one circuit board and said encapsulated IC.
- 10 24. The method of claim 23 wherein the electrically coupling comprises forming one or more vias in said at least one circuit board.
25. A dielectric matrix element configured to accommodate a dielectric gas or fluid between an integrated circuit (IC) substrate and an encapsulation element of said IC substrate, to thereby provide air-gap-like conditions to at least one micro-device formed
15 in or on said IC substrate.
26. The dielectric matrix element of claim 25 comprising a breathable or permeable material.
27. The dielectric matrix element of claim 26 comprising fibrous, mesh, and/or perforated material.
- 20 28. The dielectric matrix element of any one of claims 25 to 27 comprising at least one of loop elements, hook elements, bristle elements, open or closed cells or cavities, or any combination thereof.