CLAIMS

What is claimed is:

1. A system comprising:

an image sensor structure comprising:

an image layer disposed over a base substrate,

a device stack disposed over the image layer,

a bond pad disposed in the device stack,

a passivation stack disposed over the device stack and the bond pad,

an array of nanowells disposed in a top layer of the passivation stack,

a through-silicon via (TSV) in electrical contact with the bond pad, the TSV extending through the base substrate, and

a redistribution layer (RDL) disposed on a bottom surface of the base substrate, the RDL in electrical contact with the TSV; and

a flow cell disposed upon the top layer of the passivation stack to form a flow channel therebetween;

wherein the flow channel is disposed over the array of nanowells and the bond pad.

2. The system of claim 1, comprising:

a first (1^{st}) environmental protection layer disposed over a 1^{st} portion of the RDL;

mechanical support structures disposed over the 1^{st} environmental protection layer.; and

wires bonded in electrical contact to a second (2^{nd}) portion of the RDL.

3. The system of claim 2, comprising:

a 2^{nd} environmental protection layer disposed over the 2^{nd} portion of the RDL;

wherein the 1^{st} and 2^{nd} environmental protection layers cover the entire RDL.

4. The system of claim 1, wherein the bond pad is a plurality of bond pads over which the flow channel is disposed.

5. The system of claim 1, wherein the passivation stack comprises:

a 1^{st} passivation layer disposed over the device stack and the bond pad; and

a 1^{st} chemical protection layer disposed over the 1^{st} passivation layer.

6. The system of claim 5, wherein the passivation stack comprises:

a 2nd passivation layer disposed over the 1st chemical protection layer; and

a 2nd chemical protection layer disposed over the 2nd passivation layer.

7. The system of any one of claims 1 to 6, comprising:

an array of light detectors disposed in the image layer; and

an array of light guides disposed in the device stack, each light guide associated with at least one light detector of the array of light detectors.

8. The system of claim 7, wherein the passivation stack comprises a bottom surface in direct contact with a top surface of the light guides.

9. The system of any one of claims 1 to 8, wherein the flow cell comprises:

a flow cell lid affixed to flow cell sidewalls, the flowcell sidewalls being bonded to the top layer of the passivation stack;

wherein the flowcell channel is formed by the flow cell lid, flow cell sidewalls and top layer of the passivation stack.

10. The system of any one of claims 1 to 9, comprising:

a light shield layer disposed between the device stack and the passivation stack;

wherein, the bond pad extends through the light shield layer.

11. The system of any one of claims 1 to 10, wherein a top surface of the bond pad is disposed below a bottom surface of the passivation stack.

12. A system comprising:

an image sensor structure comprising:

an image layer disposed over a base substrate, the image layer comprising an array of light detectors disposed therein,

a device stack disposed over the image layer,

a plurality of bond pads disposed in the device stack,

an array of light guides disposed in the device stack,

a passivation stack disposed over the device stack and the plurality of bond pads,

an array of nanowells disposed in a top layer of the passivation stack,

through-silicon via (TSV) in electrical contact with the bond pads of the plurality of bond pads, the TSV extending through the base substrate, and

a redistribution layer (RDL) disposed on a bottom surface of the base substrate, the RDL in electrical contact with the TSV; and

a flow cell disposed upon the top layer of the passivation stack to form a flow channel therebetween;

wherein the flow channel is disposed over the array of nanowells and the plurality of bond pads.

13. The system of claim 12, comprising:

a 1^{st} environmental protection layer disposed over a 1^{st} portion of the RDL;

mechanical support structures disposed over the 1^{st} environmental protection layer;

wires bonded in electrical contact to a 2^{nd} portion of the RDL; and

a 2^{nd} environmental protection layer disposed over the 2^{nd} portion of the RDL;

wherein the 1^{st} and 2^{nd} environmental protection layers cover the entire RDL.

14. The system of claim 12 or 13, wherein the passivation stack comprises:

a 1st passivation layer disposed over the device stack and the plurality of bond pads; and

a 1st chemical protection layer disposed over the 1st passivation layer.

15. The system of claim 14, wherein the passivation stack comprises:

a 2nd passivation layer disposed over the 1st chemical protection layer; and

a 2nd chemical protection layer disposed over the 2nd passivation layer.

16. A method comprising:

disposing a device stack and an image layer over a base substrate layer respectively;

disposing a bond pad in the device stack;

disposing at least a portion of a passivation stack over the device stack and the bond pad;

forming an array of nanowells in a top layer of the passivation stack;

etching a TSV through a bottom surface of the base substrate, the TSV extending to the bond pad;

plating the TSV to make electrical contact with the bond pad;

disposing an RDL on the bottom surface of the base substrate, the RDL in electrical contact with the TSV; and

disposing a flow cell upon the top layer of the passivation stack to form a flow channel therebetween, wherein the flow channel is disposed over the array of nanowells and the bond pad.

17. The method of claim 16, comprising:

disposing a 1st environmental protection layer over a 1st portion of the RDL;

bonding mechanical support structures over the 1st environmental protection layer; and

bonding wire to a 2nd portion of the RDL, the bonded wire in electrical contact with the RDL.

18. The method of claim 17, comprising:

disposing a 2nd environmental protection layer over the 2nd portion of the RDL; and

covering the RDL entirely with the 1st and 2nd environmental protection layers.

19. The method of any one of claims 16 to 18, wherein disposing at least a portion of a passivation stack comprises:

disposing a 1st passivation layer over the device stack and the bond pad;

disposing a 1st chemical protection layer over the 1st passivation layer; and

disposing a 2nd passivation layer over the 1st chemical protection layer.

20. The method of claim 19, wherein forming an array of nanowells comprises:

etching the array of nanowells in the 2nd passivation layer; and

disposing a 2nd chemical protection layer over the 2nd passivation layer.