What is claimed is:

1. A digital microfluidics (DMF) cartridge, comprising:

a first substrate comprising one or more electrowetting electrodes for conducting droplet operations;

a second substrate offset from the first substrate;

a droplet operations gap defined between the first substrate and the second substrate, wherein the one or more electrowetting electrodes are operative to perform droplet operations on a liquid droplet in the droplet operations gap; and

a sensing region in the droplet operations gap for contact with the liquid droplet; and

a fiber optic probe that provides excitation light from a primary illumination source to the sensing region and emission light from the sensing region to a primary optical measurement device.

2. The DMF cartridge of claim 1, wherein the sensing region comprises a sensor surface disposed on a terminal surface portion of the fiber optical probe.

3. The DMF cartridge of any one of claims 1-2, wherein the sensing region is disposed in the droplet operations gap in proximity to the one or more electrowetting electrodes such that the liquid droplet will contact the sensing region.

4. The DMF cartridge of any one of claims 1-3, wherein the fiber optic probe extends through the first substrate to dispose the sensing region in the droplet operations gap.

5. The DMF cartridge of any one of claims 1-4, wherein the fiber optic probe extends through the second substrate to dispose the sensing region in the droplet operations gap.

6. The DMF cartridge of any one of claims 1-5, wherein the fiber optic probe extends into the droplet operations gap between the first and second substrate substantially parallel to the first substrate and the second substrate to dispose the sensing region in the droplet operations gap.

7. The DMF cartridge of any one of claims 1-6, wherein at least one of the first substrate or the second substrate comprises at least one opening for introduction of a liquid into the droplet operations gap.

8. The DMF cartridge of any one of claims 1-7, wherein the sensing region comprises a ligand.

9. The DMF cartridge of any one of claims 1-8, wherein the sensing region comprises a nanoparticle sensor surface.

10. The DMF cartridge of any one of claims 1-9, wherein the fiber optic probe comprises one or more optical elements at the terminal surface portion.

11. The DMF cartridge of any one of claims 1-10, wherein the droplet operations gap contains a filler substrate that is immiscible within the liquid droplet.

12. The DMF cartridge of any one of claims 1-11, wherein the first substrate and the second substrate comprise a material sufficiently transparent to allow excitation light from a secondary illumination source to pass through the first substrate to the sensing region and emission light from the sensing region to pass through the second substrate onto a secondary optical measurement device.

13. A digital microfluidics (DMF) system comprising:

a DMF cartridge according to any one of claims 1-12;

one or more illumination sources, wherein the one or more illumination sources supplies the excitation light to the sensing region of the DMF cartridge via the fiber optic probe; and

one or more optical measurement devices, wherein the one or more optical measurement devices receives and processes the emission light from the sensing region via the fiber optic probe.

14. The DMF system of claim 14, further comprising:

a controller in operative communication with the one or more electrowetting electrodes to control the conducting of the droplet operations by the one or more electrowetting electrodes.

15. A DMF system, the system comprising:

a cartridge comprising:

digital microfluidics comprising a plurality of electrowetting electrodes operative to perform droplet operations on a liquid droplet in a droplet operations gap; and

a fiber optic probe projecting into the droplet operations gap into proximity with a set of two or more of the electrowetting electrodes such that a droplet situated atop any electrode of the set of two or more electrodes will contact the fiber optic probe;

a controller operationally coupled to the electrowetting electrodes and the fiber optic probe;

an illumination source arranged to illuminate one or more droplets in the droplet operations gap; and

an optical measurement device optically coupled to the fiber optic probe and arranged to receive signal from the fiber optic probe.