



Supporting Information

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Vertical Addressing of 1-Plane Electrodes for Digital
Microfluidics

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Supplementary Information for

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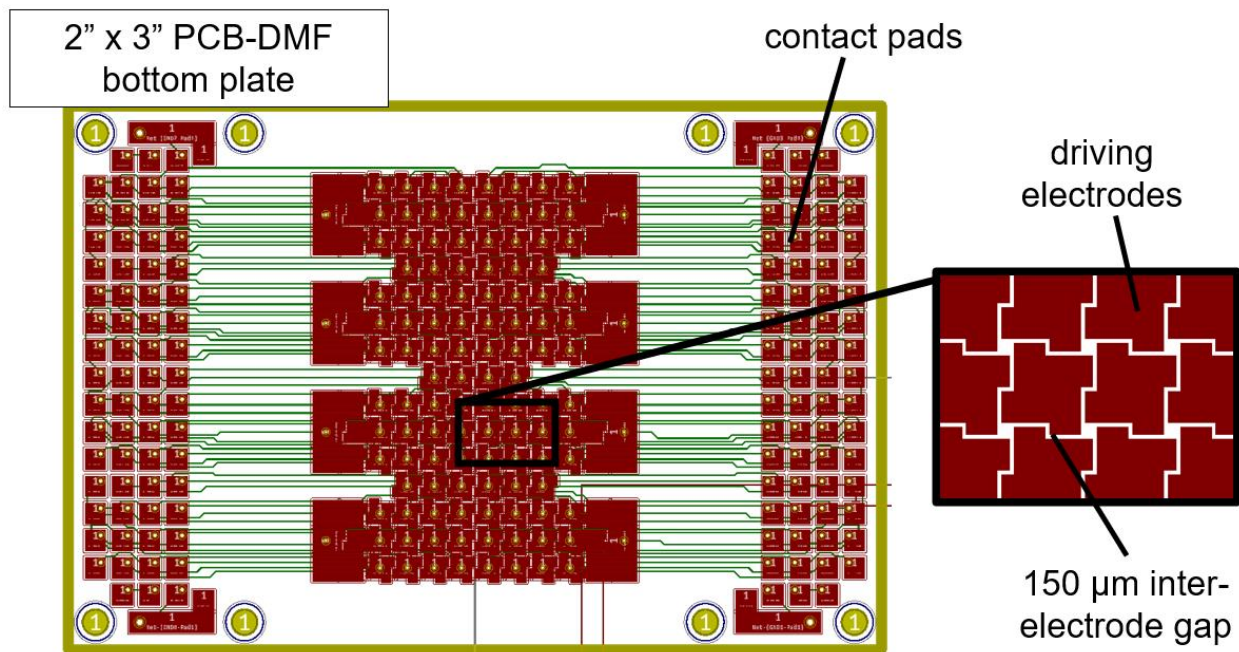


Figure S1: Design 1 – standard PCB-DMF bottom plate. KiCAD layout of PCB design 1, which is used as the bottom plate of a conventional DMF device. The array of 120 actuation electrodes (including 104 driving electrodes, 8 dispensing electrodes, and 8 reservoir electrodes) is in the center (red), and the contact pads for interfacing with the droplet control system are on the left and right edges, respectively (red). Each electrode is vertically connected to the bus layer below, where conductive traces (green) connect each actuation electrode to its respective contact pad. The call-out (right, black-outline) is a magnified view of a few of the driving electrodes.

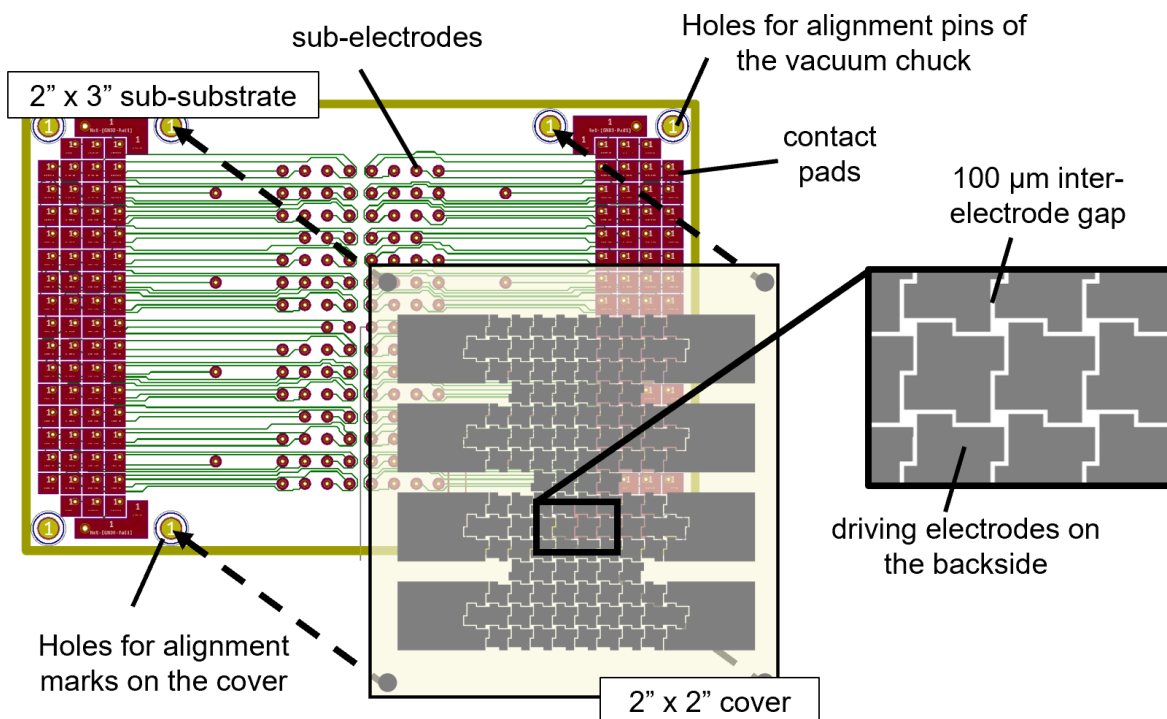


Figure S2: Design 2 - VAPE device with 120 electrodes. KiCAD layout of the sub-substrate (left, background) and schematic of the cover (right, foreground) of a VAPE-DMF device featuring design 2. The sub-substrate features an array of 120 circular sub-electrodes in the center (in red), and the contact pads for interfacing with the droplet control system are on the left and right edges, respectively (red). Each sub-electrode is vertically connected to the bus layer underneath, where conductive traces (green) connect each actuation electrode to its respective contact pad. The 120 sub-electrodes are designed to line up with an array of actuation electrodes (including 108 driving electrodes, 8 dispensing electrodes, and 8 reservoir electrodes) on the cover (gray). The call-out (right, black-outline) is a magnified view of two of a few driving electrodes.

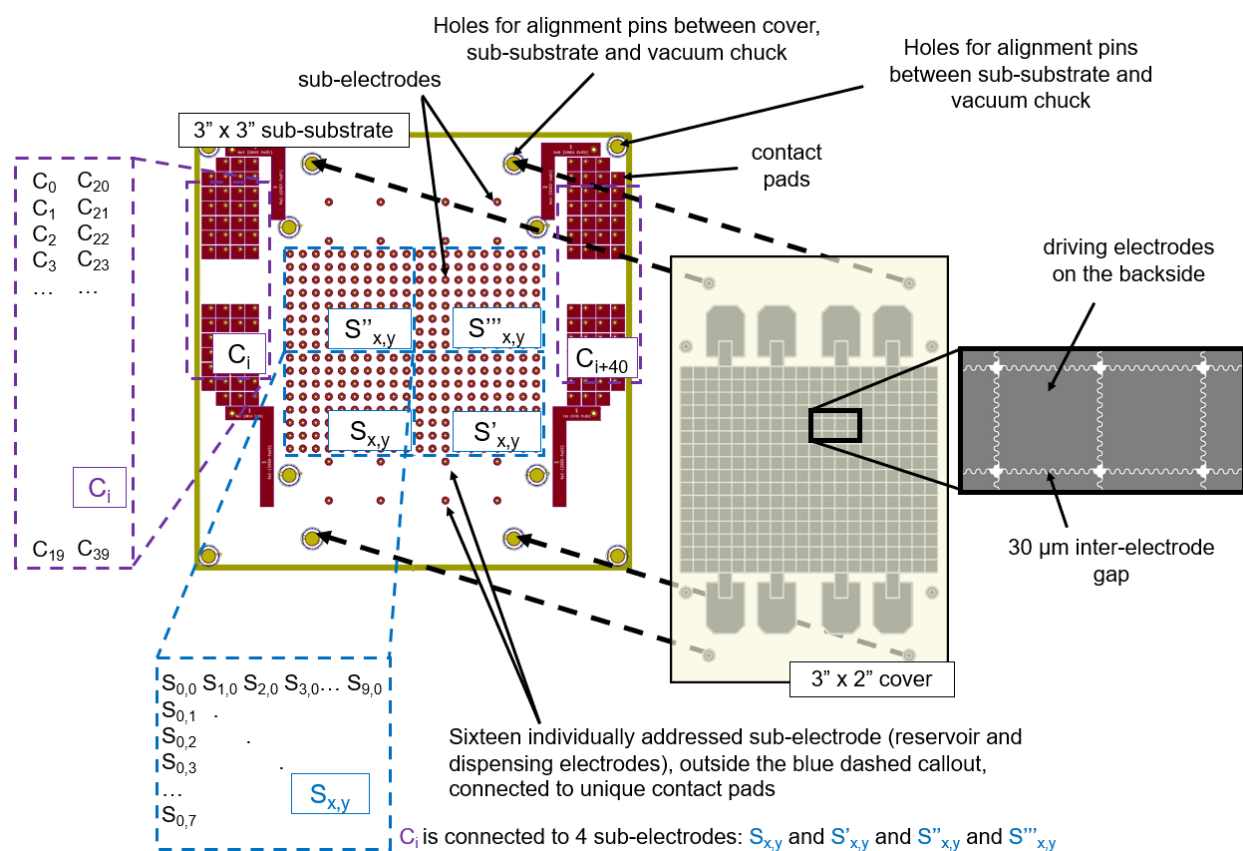


Figure S3: Design 3 - VAPE device with 336 electrodes. KiCAD layout of the sub-substrate (left, background) and schematic of the cover (right, foreground) of a VAPE-DMF device featuring design 3. The sub-substrate features an array of 336 circular sub-electrodes in the center (in red). Of that number, 320 of the sub-electrodes are in a 16 (rows) x 20 (columns) array that is itself sub-divided into four 8 x 10 sub-arrays: ($S_{x,y}$, $S'_{x,y}$, $S''_{x,y}$, $S'''_{x,y}$, blue dashed lines, callout). The sub-substrate also features contact pads for interfacing with the droplet control system are on the left and right edges, respectively (red). Eighty of the contact pads (C_i , purple dashed lines, callout) were designated as multi-connector pads. Each sub-electrode is vertically connected to the bus layer underneath, where conductive traces (not shown) connect each actuation electrode to its respective contact pad. Each element in the multi-connector pads (C_i) was connected in parallel with four analogous sub-electrodes in each of the sub-arrays ($S_{x,y}$, $S'_{x,y}$, $S''_{x,y}$, $S'''_{x,y}$). The 336 sub-electrodes are designed to line up with an array of actuation electrodes (including 320 driving electrodes, 8 dispensing electrodes, and 8 reservoir electrodes) on the cover (gray). The call-out (right, black-outline) is a magnified view of two of the driving electrodes.