



## Electronics and Control Systems for Portable Electro-wetting on Dielectric Device

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### *Abstract*

This paper presents the electronic controller designs with a high voltage power supply adapter for EWOD device. Since a control for EWOD requires both fast response of a switch and stability of high voltage, the electronics device must contain controller circuits and a high voltage power adapter to produce a high voltage for droplet excitation. The high voltage power supply adapter contains a transformer and voltage multiplier circuits. Another electronic controllers are a MOSFET pull-up switch that receives a signal from a serial-to-parallel converter and distributes a logic signal from a microcontroller to each EWOD pads. The goal is to manipulate droplets by a phenomenon of the electro-wetting and develop a suitable HV with electronic switches scheme. The simulation in PSIM® predicts an output voltage of 381 V, that is 11 times of the AC input voltage, while testing with the AC 24 V<sub>RMS</sub>, 50 Hz. The side effect is voltage drop during synchronizing periods with pull-up switches. The experiment with all load from switches showed the result of 268 V to EWODs. This is resulted from a capacitive discharge in the overall circuit and it can be eliminated if a larger resistor is used or adjusts the circuit-charging rate with higher frequency input. In this design, the 10MΩ pull-up resistors is included in the switch design to minimize the discharge effect. The overall design will be validated in the future work and developed for the discharge issue. The targeted applications for this electronics device are for a point-of-care (POC), the clinical diagnosis in distant and rural areas, and also for a portable microfluidic testing

**Keywords:** Electrowetting-on-dielectric (EWOD), microfluidic system, droplet manipulation, high DC voltage adapter, voltage multiplier circuit, point-of-care (POC), clinical diagnosis