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Abstract for an Invited Paper
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A Piezo-Electronic Solid-state Switch Capable of High Speed and Low Power[1]

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Society has witnessed an incredible digital revolution over the past half century starting with the integration of a few transistors in the 1960's. By shrinking the transistor (scaling) and reducing voltage simultaneously, numbers of transistors could be increased, and speed increased as well, without paying a penalty in terms of increased power. This free lunch continued for decades with huge increases in transistor number until today there are billions per chip with multi gigahertz clock rates. In the past decade the process of voltage reduction has come to an end because fundamental limits for field-effect transistors are being approached, and as a result power dissipation has soared. To continue down the scaling path a switch utilizing new physical principles is required, not subject to the same voltage limits. For this we proposed [1] a switch based on electro-mechanical transduction – the Piezoelectronic Transistor (PET): An input voltage applied across a piezoelectric crystal causes a pressure wave which compresses a piezoresistive element resulting in a large change in its conductivity of several orders of magnitude. With this basic switch one can scale to lower voltages than the FET Furthermore, the stiff and short mechanical path permits multi-GHz speeds notwithstanding relatively slow acoustic velocities. In this talk we will explore the properties of the PET, the physics of its operation, analysis of its performance potential and applicability to future logic systems. In addition experimental results of our group toward realization of the PET will also be presented.

[1] Newns, D., Elmegreen, B., Liu, X-H & Martyna, G. A . *J. Appl. Phys.*, **111**, 084509 (2012).

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