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Energetics of Metal-Insulator Transition Field-Effect Transistors using Vanadium Oxide Thin Films SAHAND HORMOZ, SHRIRAM RAMANATHAN, School of Engineering and Applied Sciences, Harvard University — There is growing interest in exploring the use of metal-oxide materials as an alternative to traditional semiconductors in field effect transistors (FET), as current Si FET technology inevitably encounters intrinsic scaling limitations. We discuss the prospect of a thin film Vanadium Oxide Mott metal-insulator transition (MIT) field- effect transistor as an electronic logic switch. Focusing on the intrinsic material properties of VO_2 and the underlying physical mechanisms of its MIT, we estimate the energy dissipation and time delay per switching operation. The device-independent power-delay plane of VO_2 Mott transistors is presented and its scaling limits compared to that of Si. Our simple model predicts an intrinsic VO_2 material lower bound switching time of the order of 0.5 ps at a power transfer of 0.1 μW.

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