

A Unified Model of MIS and Ridge HEMTs for Fast and High-Power Switching Applications

Abstract—A verilog-A based compact model of AlN/GaN based MIS (Metal Insulator Semiconductor) -HEMT (High Electron Mobility Transistor)s and ridge (Gate Injection Transistor) HEMTs has been developed for embedded-source-field-plate (ESFP) structures. Characteristic differences in these two structures are theoretically and experimentally analyzed with measurements of fabricated devices. For ridge HEMTs, hole injection current and leakage current are focused on, whereas the MIS-HEMTs use a MOSFET gate modeling approach. Also, the parasitic transistor model caused by the ESFP is developed. For high frequency operations, S-parameter characterizations with G-S-G pads structures for both types of HEMTs are fabricated. Because the simulation results show good agreements with the measurements, one model can be applied to both MIS and ridge HEMTs to design switching power supply circuits.