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DC and RF Characterization of Laser Annealed Metal-Gate SOI CMOS Field-Effect-Transistors RYAN P. LU, BRUCE W. OFFORD, JEREMY POPP, AYAX D. RAMIREZ, JASON ROWLAND, STEPHEN D. RUSSELL[1], SPAWAR Systems Center — The conventional polysilicon gate in a MOSFET has been replaced by an aluminum metal gate which offers higher RF performance through the reduction of gate resistance. Pulsed excimer laser annealing of the source and drain was then used to avoid conventional furnace annealing that would melt the aluminum metal gate. CMOS field effect transistors utilizing metal-gates were fabricated in SOI technology down to 0.25 micron gate lengths. The DC characteristics of devices with 10 micron gate lengths were consistently well-behaved. The 0.25 micron devices were found to be more sensitive to the laser energy which showed up in the DC measurements in threshold voltage variations and larger leakage currents in the subthreshold characteristics. At higher laser fluences, TCAD simulations show excessive lateral diffusion, explaining the observed effects. RF results of the drawn 0.25 micron metal-gate devices have an F_t and F_{max} of 25 GHz and 60 GHz, respectively. Similar devices with polysilicon gates were fabricated and characterized for comparison. RF results of the drawn 0.25 micron polysilicon-gate devices have an F_t and F_{max} of 34 GHz and 7 GHz, respectively.This device processing advance offers a deeply scalable technology for future "system-on-a-chip" applications.

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