

CHARACTERIZATION OF SUB-90 nm GATE LENGTH RF MOSFETS USING LARGE SIGNAL NETWORK ANALYZER

By

Venkatesh Balasubramanian, M.S.

The Ohio State University, 2009

Prof. Patrick Roblin, Adviser

This thesis presents a methodology to characterize sub 90 nm gate length RF MOSFETs used for PA applications. First, MATLAB and ADS are used to fit the gate and the drain pads' parameters with the small signal S-parameters measured over a range of frequencies. Then, test beds for Class A and Class B Power Amplifiers in Common Source (CS) and Common Gate (CG) configuration are designed in ADS to compare the simulation results with the measured data from the Large Signal Network Analyzer (LSNA). CG configuration based Power Amplifiers are further studied to test the device symmetry by injecting signals from both the source as well as the drain side. Realizing that over 50 % of the output admittance can be accounted by the substrate network, a scheme is developed to study the substrate of the device using LSNA as all the previous models proposed in the literature are based on small signal measurements. Signals are injected at low frequency (600

MHz) and high frequency (4 GHz) to account for all possible components and a_1 , a_2 , b_1 and b_2 parameters are measured using LSNA. The effect of harmonics on the device performance was studied to find the optimum number of harmonics beyond which there was no appreciable variation in the performance by introducing figure of merits. Finally, pulsed-IV/RF measurements were simulated in ADS for class B operation to validate the experimental test beds involving LSNA.