Regular paper

Oxide Thickness Dependent Compact Model of Channel Noise for E–Mode AlGaN/GaN MOS-HEMT

D.K. Panda, T.R. Lenka

PII: S1434-8411(17)31841-1
DOI: https://doi.org/10.1016/j.aeue.2017.09.025
Reference: AEUE 52096

To appear in: *International Journal of Electronics and Communications*

Received Date: 31 July 2017
Accepted Date: 27 September 2017

Please cite this article as: D.K. Panda, T.R. Lenka, Oxide Thickness Dependent Compact Model of Channel Noise for E–Mode AlGaN/GaN MOS-HEMT, *International Journal of Electronics and Communications* (2017), doi: https://doi.org/10.1016/j.aeue.2017.09.025

Oxide Thickness Dependent Compact Model of Channel Noise for E–Mode AlGaN/GaN MOS-HEMT

D. K. Panda and T. R. Lenka
Microelectronics and VLSI Design Group, Department of Electronics and Communication Engineering,
National Institute of Technology Silchar, Assam, 788010, India.
E-mail: d.panda.2016@ieee.org, t.r.lenka@ieee.org

***Abstract*— In this paper, a compact channel noise model for gate recessed enhancement mode GaN based MOS-HEMT which is valid for all regions of operation is proposed. The compact noise model consists of high frequency thermal noise and low frequency flicker noise. The drain current, which is one of the most important parameters for compact noise model is developed by incorporating interface and oxide traps, mobility degradation due to vertical electric field, velocity saturation effect and self-heating effect. The flicker noise model is derived by considering mobility and carrier fluctuation due to traps present in both oxide and interface layer. The thermal noise and flicker noise models are validated by comparing the results with TCAD simulation and experimental results from literature respectively. Effect of thermal and flicker noise power spectral density (PSD) variation with different oxide thickness has also been analyzed.**

***Index Terms*— AlGaN, Flicker noise, GaN, MOS-HEMT, Thermal noise, TCAD**

1. Introduction

AIGaN/GaN high electron mobility transistor (HEMT) is one of the most promising candidates suitable for high power, high frequency (HF) [1-2] and low noise applications [3] due to the unique material properties of GaN. Although GaN based HEMT provides comparatively low noise performance as compared to GaAs or InP technologies [4] but it does not require any protection circuits like limiter [5]. Hence RF receiver using GaN HEMT shows better noise performance. Due to thin barrier layer and limited Schottky barrier height, GaN HEMT has a higher gate leakage current which results in high noise, poor off-state performance and low forward bias swing [6]. In order to overcome these problems metal-oxide-