

Abstracts

DC, RF, and microwave noise performances of AlGaN/GaN HEMTs on sapphire substrates

W. Lu, V. Kumar, R. Schwindt, E. Piner and I. Adesida. "DC, RF, and microwave noise performances of AlGaN/GaN HEMTs on sapphire substrates." 2002 Transactions on Microwave Theory and Techniques 50.11 (Nov. 2002 [T-MTT] (Mini-Special Issue on the 2002 IEEE Radio Frequency Integrated Circuit (RFIC) Symposium)): 2499-2504.

High-performance AlGaN/GaN high electron-mobility transistors with 0.18-spl μ m gate length have been fabricated on a sapphire substrate. The devices exhibited an extrinsic transconductance of 212 mS/mm, a unity current gain cutoff frequency ($f_{\text{sub } T}$) of 101 GHz, and a maximum oscillation frequency ($f_{\text{sub MAX}}$) of 140 GHz. At $V_{\text{sub ds}}=4$ V and $I_{\text{sub ds}}=39.4$ mA/mm, the devices exhibited a minimum noise figure ($NF_{\text{sub min}}$) of 0.48 dB and an associated gain (G_a) of 11.16 dB at 12 GHz. Also, at a fixed drain bias of 4 V with the drain current swept, the lowest NF_{min} of 0.48 dB at 12 GHz was obtained at $I_{\text{sub ds}}=40$ mA/mm, and a peak $G_{\text{sub a}}$ of 11.71 dB at 12 GHz was obtained at $I_{\text{sub ds}}=60$ mA/mm. With the drain current held at 40 mA/mm and drain bias swept, the $NF_{\text{sub min}}$, increased almost linearly with the increase of drain bias. Meanwhile, the G_a values decreased linearly with the increase of drain bias. At a fixed bias condition ($V_{\text{sub ds}}=4$ V and $I_{\text{sub ds}}=40$ mA/mm), the $NF_{\text{sub min}}$ values at 12 GHz increased from 0.32 dB at -55/spl deg/C to 2.78 dB at 200/spl deg/C. To our knowledge, these data represent the highest $f_{\text{sub T}}$ and $f_{\text{sub MAX}}$, and the best microwave noise performance of any GaN-based FETs on sapphire substrates ever reported.

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