

# **SURFACE ENGINEERING FOR HIGH EFFICENCY GAN HEMTS**

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High Electron Mobility Transistors (HEMT) based on III-Nitrides have demonstrated excellent microwave performance as power transistors, owing to the large bandgaps of the materials they are as made of, as well as the high band offset and high electron mobility observed in the AlGa<sub>N</sub>/Ga<sub>N</sub> heterojunctions. Nevertheless, the microwave performance of Ga<sub>N</sub> HEMTs is still largely determined by their surface condition due to the inherent high polarization fields present in their epistructure. Such performance degradation mechanisms are often referred as Gate-lag.

In this paper, different surface engineering approaches for mitigating negative surface influence on the device performance are investigated. Different passivation materials, dielectric deposition methods, device fabrication technique and epistructure (Ga<sub>N</sub> Cap layers) device (recess) have been studied for the optimization of Ga<sub>N</sub> device performances. As a result, optimized structures have demonstrated about 6 W/mm and 10 W/mm of CW output power density for Ga<sub>N</sub> HEMTs grown on sapphire and SiC respectively.