高頻功率氮化銦鋁/氮化鎵高電子遷移率電晶體技術開發與研究

Development of InAlN/GaN HEMT for High Power and High Frequency Applications

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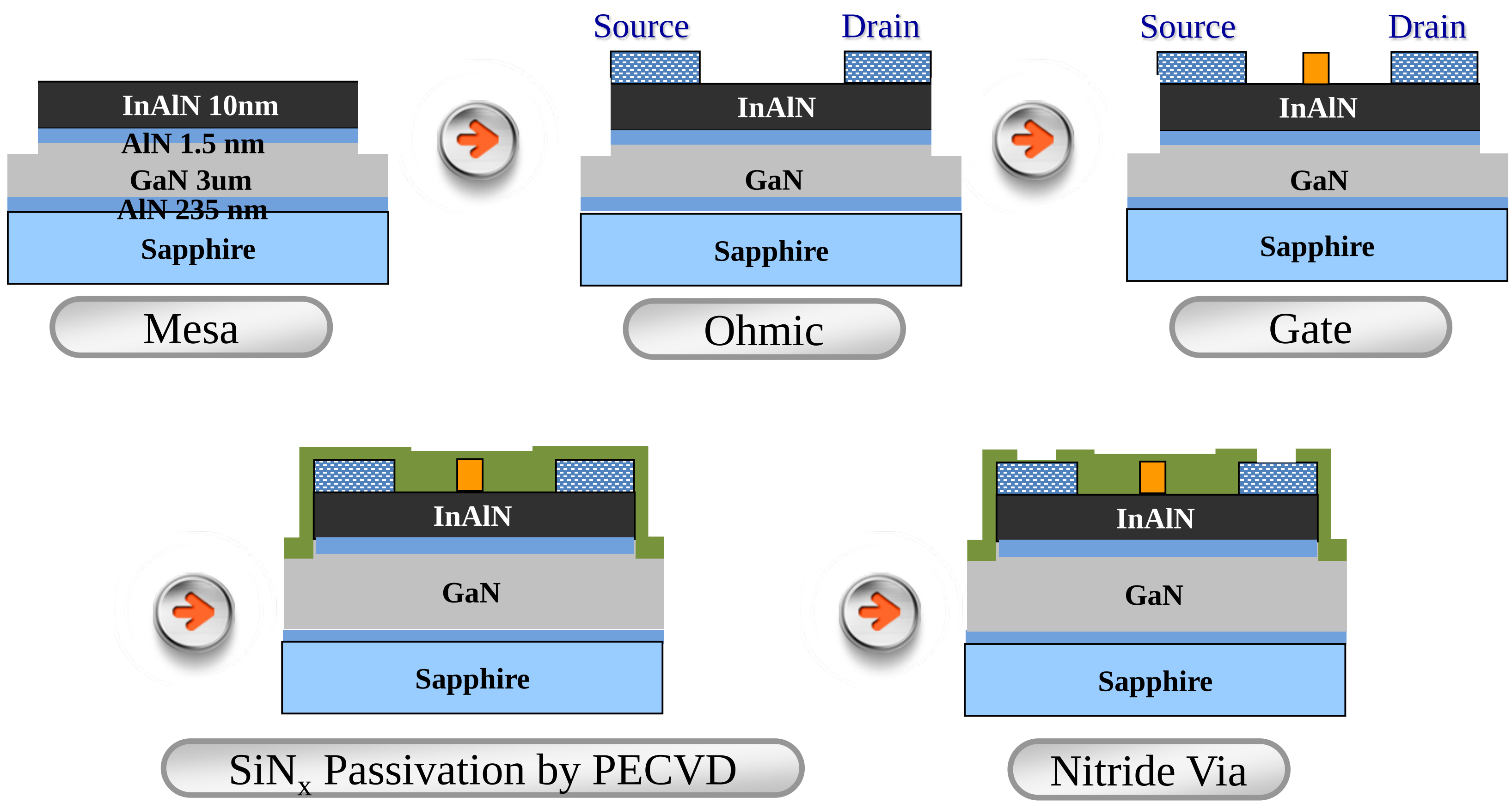
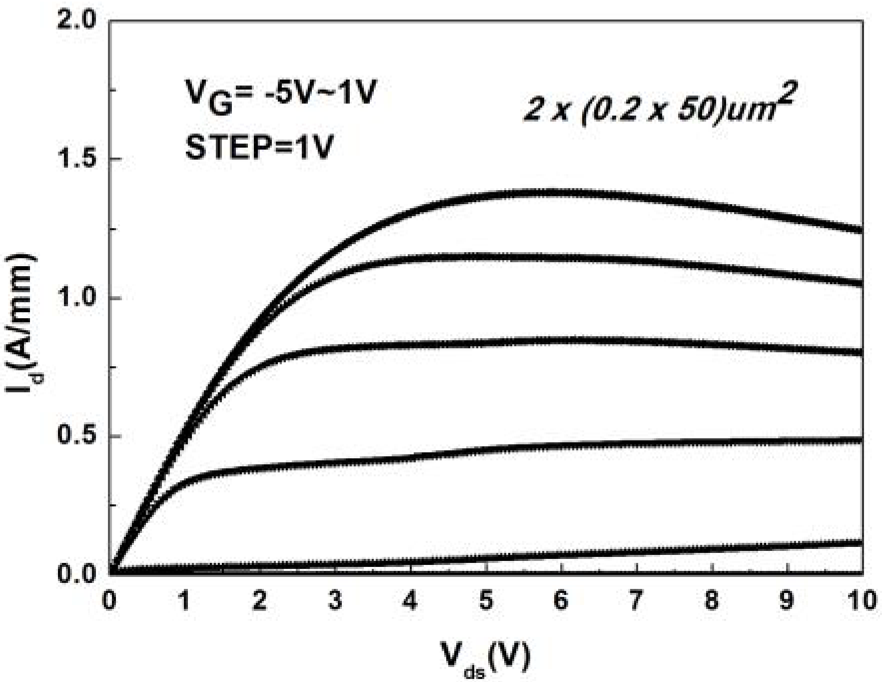
Process flow

L_{SD}= 2 um
L_G= 0.2 um
W_G= 2 x 50 um

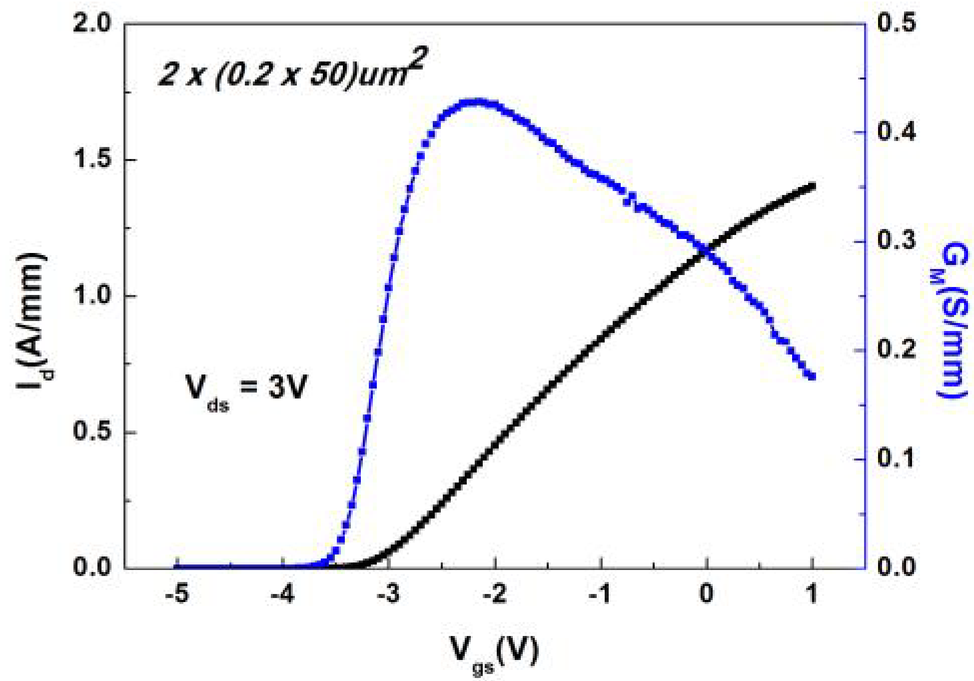


DC Measurement

(a) I_{ds}-V_{ds}

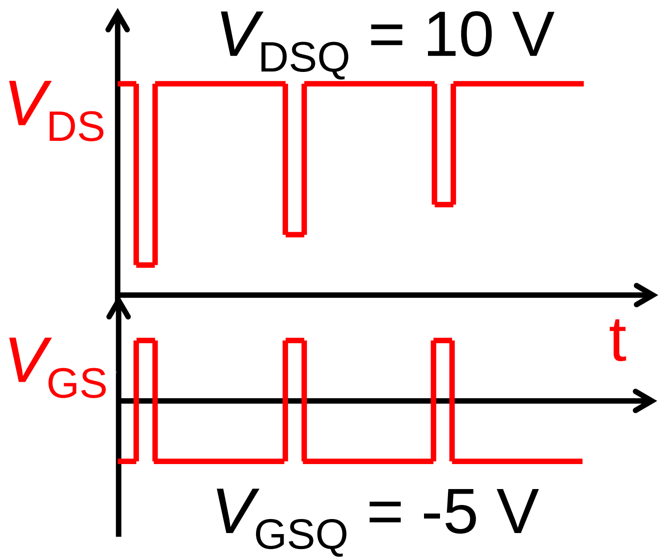


(b) Transfer curves



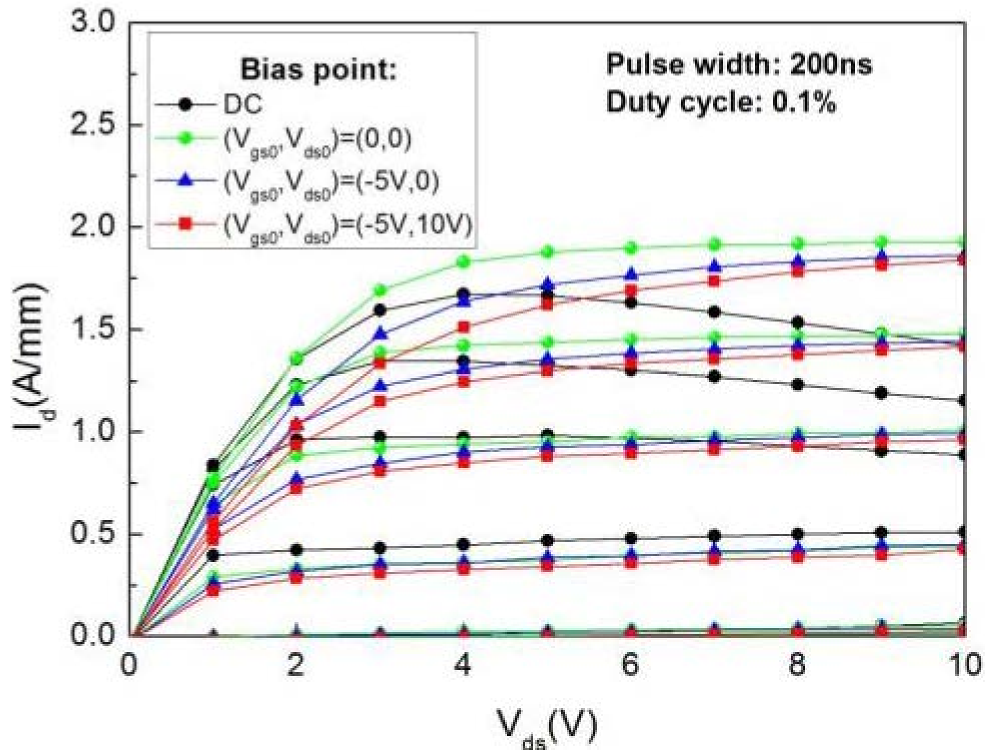
- Maximum drain current density (I_{DMAX}) = **1.38 (A/mm)** @V_{GS}=1V, V_{DS}=6V
- Peak extrinsic transconductance (g_m) = **429 (mS/mm)**

Pulse IV Measurement



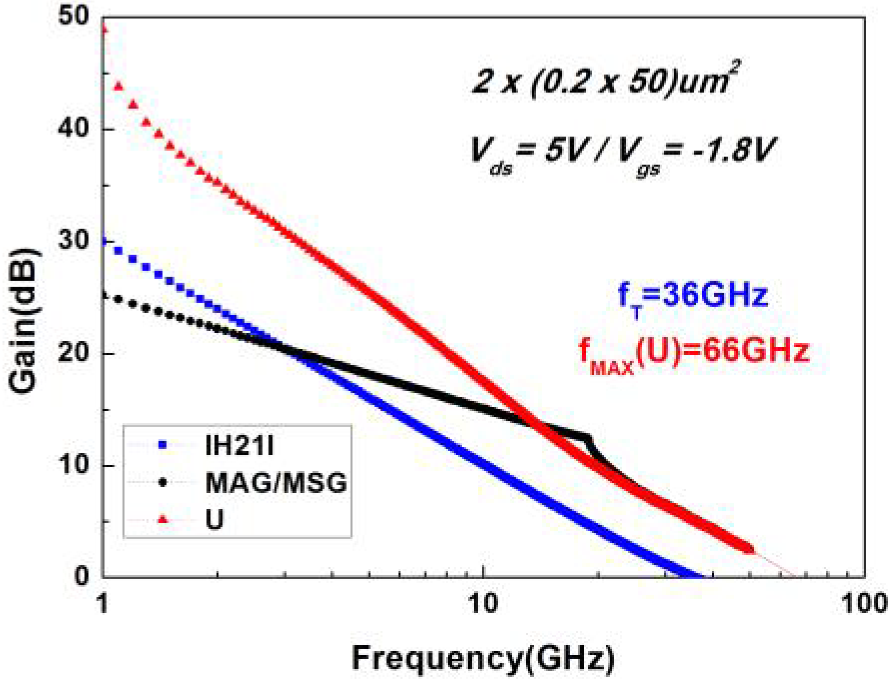
Gate lag: 5.7%
Drain lag: 9.7%

(a) Pulse IV characteristics for different bias point for the 2 x 0.2 x 25 um^2 InAlN/AlN/GaN HEMT

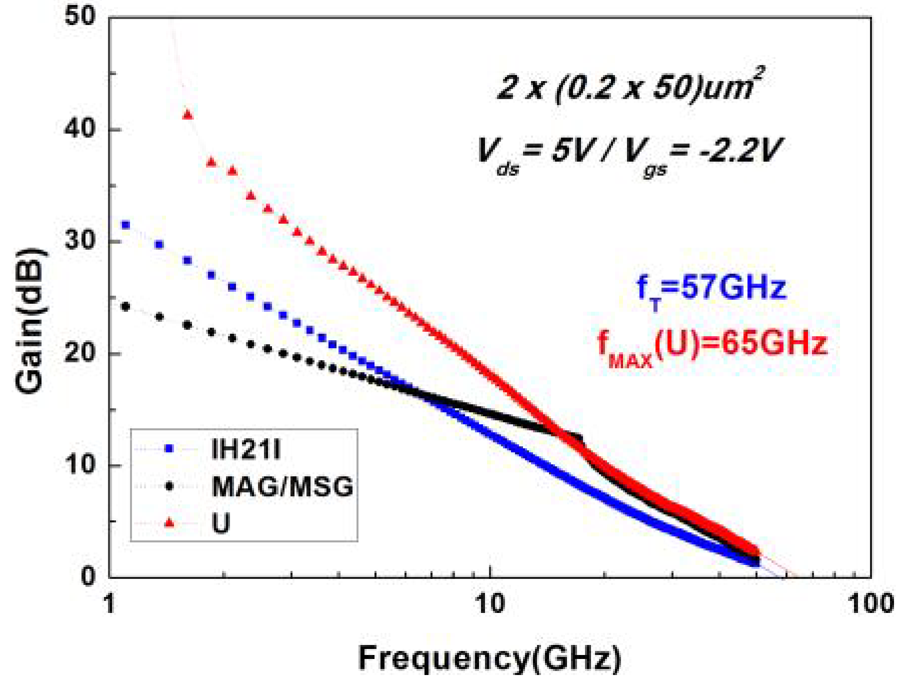


Small-signal RF characteristics

(a) W/O passivation
(Before pad deembedded)



(b) With SiN_x passivation
(Before pad deembedded)



Conclusions

1. Passivation is important to mitigate the trap activity and to enhance the device performance.

2. After 110nm SiNx passivation by PECVD, a 5.7% and 9.7% reduction in the maximum drain current is observed in the gate lag and drain lag measurement, respectively.

3. An extrapolated current gain cutoff frequency(F_T) of 57GHz and a maximum power gain cutoff frequency (F_{MAX}) of 65GHz are obtained after SiN_x passivation by PECVD