【1. Background】
The high \( V_B \), collapse-free and high current GaN PSJ (Polarization super-junction) FETs have been fabricated and the next step will be the realization of the N-off mode ones.

【2. Purpose】
To achieve GaN PSJ-FETs having \( V_{th} \) higher than +1V and \( V_B > 1,200V \)

【4. N-off Device Structure】
Double Gates

- G1, MIS, \( L_g=1.5\mu m \)
  - Au/Nil/SiN(10nm)/AlGaN(1~3nm)
- G2, p-Ohmic, \( L_g=5\mu m \)
  - Lpsj=15\mu m

【5. Static Characteristics】
\((W_g=1mm, L_g=1.5\mu m)\)

- \( I_d-V_d \) characteristics.
- Transfer characteristics.
- Gate-leak characteristics.

【6. Large Device】
\((W_g=281mm, L_g=1.5\mu m)\)

- \( I_d-V_d \) characteristics.
- Transfer characteristics.
- Gate-leak characteristics.

【7. Discussion】
- Both Normally-off and high \( V_B \), obtained result from the formation of the Cascode circuit between source and drain.
- The field in the AlGaN next to the G1 is kept small with increasing drain voltage, which results in the constant and small G1 leakage current.

【8. Summary】
1. N-off type PSJ-FET was achieved by implementing a trench MIS gate in front of the PSJ gate, and its \( V_{th} \) obtained was >1 Volt.
2. The large device with \( W_g=281mm \) and \( L_g=1.5\mu m \) exhibited the maximum drain current, \( I_{d,max} \), of 16A.
3. The breakdown voltage, \( V_{B} \), of the small device (\( W_g=1mm \)) was >2.2 kV and that of the large one (\( W_g=281mm \)) was >1.4kV.

【9. Conclusions】
1. The double gate N-off PSJ-FET exhibited very high breakdown voltage due to the internal Cascode conformation.
2. GaN PSJ-devices using established GaN-on-sapphire growth technique are expected to become a new type of GaN power devices.