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Vertical GaN devices and reliability

Summary:

The vertical structure of the power device has advantages such as small chip size, easy wiring, and high breakdown voltage. Furthermore, wideband gap semiconductors have the greatest feature of low on-resistance. GaN is a material having the ability to fully exhibit these properties and in recent years development of GaN vertical devices has been accelerated. For example, GaN vertical devices with over 1kV breakdown voltage have been reported recently. Moreover, over 3kV pn diodes were also reported. Therefore, ability of GaN for high voltage devices has already been proven. Next issues are developments of fabrication process technologies which make devices stable operation. In this presentation, we will report recent our advances in process technologies for GaN vertical devices, which are high quality GaN epitaxial growth technology, dry etching technology for trench forming of MOSFET, and Mg ion implantation and its activation for p-GaN. Especially, the Mg ion implantation will make it possible to expand the freedom of the device design and simplify the device process.