



US 20240213363A1

(19) **United States**(12) **Patent Application Publication**  
**SHEALY et al.**(10) **Pub. No.: US 2024/0213363 A1**(43) **Pub. Date: Jun. 27, 2024**(54) **VERTICAL FIELD EFFECT TRANSISTOR  
DEVICE AND METHOD OF FABRICATION****H01L 29/20** (2006.01)**H01L 29/66** (2006.01)(71) Applicant: **Odyssey Semiconductor, Inc.**, Ithaca,  
NY (US)(52) **U.S. Cl.**  
CPC ..... **H01L 29/7802** (2013.01); **H01L 29/1095**  
(2013.01); **H01L 29/2003** (2013.01); **H01L**  
**29/66522** (2013.01); **H01L 29/66712**  
(2013.01)(72) Inventors: **James R. SHEALY**, Ithaca, NY (US);  
**Richard J BROWN**, Ithaca, NY (US)(21) Appl. No.: **18/596,271**(22) Filed: **Mar. 5, 2024****Related U.S. Application Data**(60) Continuation of application No. 18/304,194, filed on  
Apr. 20, 2023, now Pat. No. 11,942,537, which is a  
continuation of application No. 17/576,355, filed on  
Jan. 14, 2022, now Pat. No. 11,652,165, which is a  
division of application No. 16/814,886, filed on Mar.  
10, 2020, now Pat. No. 11,251,295.**Publication Classification**(51) **Int. Cl.**  
**H01L 29/78** (2006.01)  
**H01L 29/10** (2006.01)(57) **ABSTRACT**

A method and vertical FET device fabricated in GaN or other suitable material. The device has a selective area implant region comprising an activated impurity configured from a bottom portion of a recessed regions, and substantially free from ion implant damage by using an annealing process. A p-type gate region is configured from the selective area implant region, and each of the recessed regions is characterized by a depth configured to physically separate an n+ type source region and the p-type gate region such that a low reverse leakage gate-source p-n junction is achieved. An extended drain region is configured from a portion of an n-type GaN region underlying the recessed regions. An n+ GaN region is formed by epitaxial growth directly overlying the backside region of the GaN substrate and a backside drain contact region configured from the n+ type GaN region overlying the backside region.

