

# (19) United States

## (12) Patent Application Publication (10) Pub. No.: US 2023/0231045 A1 YAMADA et al.

Jul. 20, 2023 (43) **Pub. Date:** 

### (54) SEMICONDUCTOR DEVICE, METHOD FOR MANUFACTURING SEMICONDUCTOR DEVICE, AND ELECTRONIC DEVICE

(71) Applicant: Fujitsu Limited, Kawasaki (JP)

(72) Inventors: Atsushi YAMADA, Hiratsuka (JP); Yuichi MINOURA, Machida (JP);

Yusuke KUMAZAKI, Atsugi (JP)

(73) Assignee: Fujitsu Limited, Kawasaki (JP)

Appl. No.: 18/049,153

(22) Filed: Oct. 24, 2022

#### (30)Foreign Application Priority Data

Jan. 17, 2022 (JP) ...... 2022-005080

### **Publication Classification**

(51) Int. Cl. H01L 29/778 (2006.01)H01L 29/04 (2006.01)

H01L 29/20	(2006.01)
H01L 29/205	(2006.01)
H01L 29/32	(2006.01)
H01L 29/417	(2006.01)
H01L 21/02	(2006.01)
H01L 29/66	(2006.01)

(52) U.S. Cl.

CPC ...... H01L 29/7786 (2013.01); H01L 29/045 (2013.01); H01L 29/2003 (2013.01); H01L 29/205 (2013.01); H01L 29/32 (2013.01); H01L 29/41766 (2013.01); H01L 21/02378 (2013.01); H01L 21/02458 (2013.01); H01L 21/0254 (2013.01); H01L 21/0262 (2013.01); H01L 29/66462 (2013.01)

#### (57)ABSTRACT

A semiconductor device includes a channel layer configured to include a first nitride semiconductor containing gallium (Ga) and a first crystal dislocation density, and a barrier layer provided over a first surface side of the channel layer, and configured to include a second nitride semiconductor containing aluminum (Al) and a second crystal dislocation density, wherein the second crystal dislocation density is larger than the first crystal dislocation density.

