



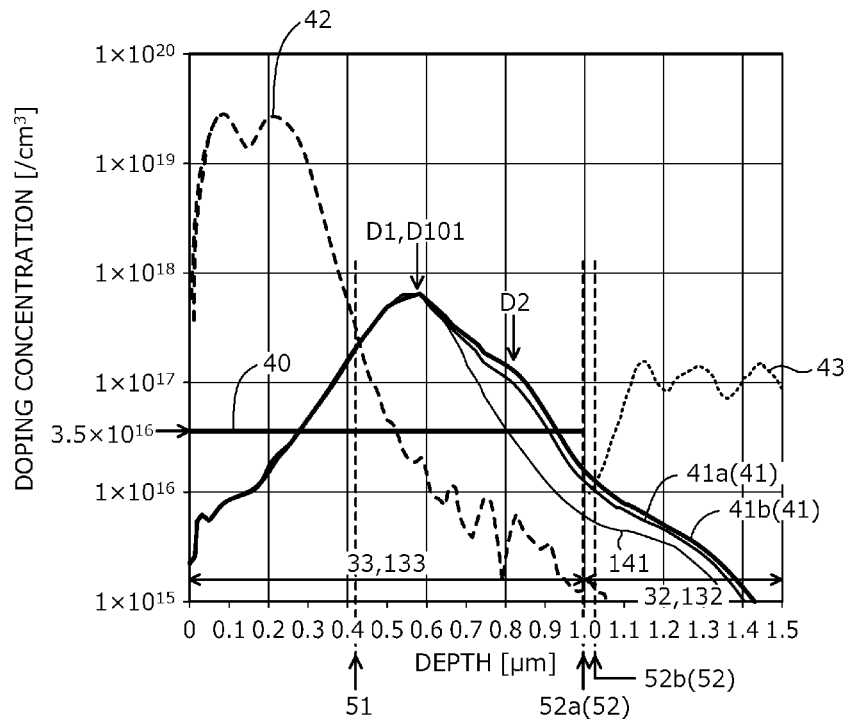
US 20240213307A1

(19) **United States**(12) **Patent Application Publication**
MORIYA et al.(10) **Pub. No.: US 2024/0213307 A1**(43) **Pub. Date: Jun. 27, 2024**(54) **SEMICONDUCTOR DEVICE AND METHOD
OF MANUFACTURING SEMICONDUCTOR
DEVICE***H01L 21/04* (2006.01)*H01L 29/16* (2006.01)*H01L 29/423* (2006.01)(71) Applicant: **FUJI ELECTRIC CO., LTD.**,
Kawasaki-shi (JP)(52) **U.S. CL.**
CPC *H01L 29/06* (2013.01); *H01L 21/02378*
(2013.01); *H01L 21/02529* (2013.01); *H01L*
21/046 (2013.01); *H01L 29/1608* (2013.01);
H01L 29/4236 (2013.01)(72) Inventors: **Tomohiro MORIYA**, Matsumoto-city
(JP); **Akimasa KINOSHITA**,
Matsumoto-city (JP)(73) Assignee: **FUJI ELECTRIC CO., LTD.**,
Kawasaki-shi (JP)(57) **ABSTRACT**(21) Appl. No.: **18/427,607**(22) Filed: **Jan. 30, 2024****Related U.S. Application Data**(63) Continuation of application No. PCT/JP2022/
047790, filed on Dec. 23, 2022.(30) **Foreign Application Priority Data**

Feb. 2, 2022 (JP) 2022-015237

Publication Classification(51) **Int. Cl.**
H01L 29/06 (2006.01)
H01L 21/02 (2006.01)

A p-type impurity concentration profile in a depth direction of a p-type base region is adjusted by two or more stages of ion implantation to the p-type base region. The two or more stages of ion implantation are each set to have a mutually different acceleration voltage and a dose amount that is lower the higher is the acceleration voltage. The p-type impurity concentration profile is asymmetrical about a depth position of a highest impurity concentration and the impurity concentration decreases from this depth position in a direction to n+-type source regions and in a direction to an n+-type drain region. In the p-type impurity concentration profile, the impurity concentration decreases, forming a step at one or more different depth positions closer to the n+-type drain region than is the depth position of the highest impurity.



— Al600keV (CONVENTIONAL EXAMPLE)
— Al600keV+Al900keV_2×10¹²/cm² (FIRST EXAMPLE)
— Al600keV+Al900keV_3×10¹²/cm² (SECOND EXAMPLE)