



US 20230230915A1

(19) **United States**

(12) **Patent Application Publication**

**Lee et al.**

(10) **Pub. No.: US 2023/0230915 A1**

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

(54) **SEMICONDUCTOR CHIP INCLUDING  
LOW-K DIELECTRIC LAYER**

(71) Applicant: **Samsung Electronics Co., Ltd.,**  
Suwon-si (KR)

(72) Inventors: **Yeonjin Lee**, Suwon-si (KR); **Junyong**  
**Noh**, Yongin-si (KR); **Minjung Choi**,  
Suwon-si (KR); **Junghoon Han**,  
Hwaseong-si (KR); **Yunrae Cho**,  
Guri-si (KR)

(21) Appl. No.: **18/127,342**

(22) Filed: **Mar. 28, 2023**

**Related U.S. Application Data**

(63) Continuation of application No. 16/848,246, filed on  
Apr. 14, 2020.

**Foreign Application Priority Data**

Aug. 20, 2019 (KR) ..... 10-2019-0101872

**Publication Classification**

(51) **Int. Cl.**

**H01L 23/522** (2006.01)  
**H01L 23/31** (2006.01)  
**H01L 23/00** (2006.01)  
**H01L 23/528** (2006.01)  
**H01L 23/48** (2006.01)  
**H01L 23/532** (2006.01)  
**H01L 21/768** (2006.01)

**H01L 23/485** (2006.01)

**H01L 21/82** (2006.01)

**H01L 21/56** (2006.01)

**H01L 21/78** (2006.01)

(52) **U.S. Cl.**

CPC ..... **H01L 23/5222** (2013.01); **H01L 23/3185**  
(2013.01); **H01L 24/05** (2013.01); **H01L**  
**23/5283** (2013.01); **H01L 23/481** (2013.01);  
**H01L 23/53295** (2013.01); **H01L 21/76832**  
(2013.01); **H01L 23/485** (2013.01); **H01L**  
**23/5226** (2013.01); **H01L 21/82** (2013.01);  
**H01L 21/561** (2013.01); **H01L 21/78**  
(2013.01); **H01L 23/562** (2013.01); **H01L**  
**2224/0237** (2013.01); **H01L 2224/024**  
(2013.01)

**ABSTRACT**

(57)

A semiconductor chip includes a device layer on a substrate, the device layer including a plurality of semiconductor devices; a wiring structure and a lower inter-wiring dielectric layer each on the device layer, the lower inter-wiring dielectric layer surrounding the wiring structure and having a lower permittivity than silicon oxide; an upper inter-wiring dielectric layer arranged on the lower inter-wiring dielectric layer; an isolation recess arranged along an edge of the substrate, the isolation recess formed on side surfaces of the lower and upper inter-wiring dielectric layers and having a bottom surface at a level equal to or lower than that of a bottom surface of the lower inter-wiring dielectric layer; and a cover dielectric layer covering the side surfaces of the lower and upper inter-wiring dielectric layers and the bottom surface of the isolation recess.

