



US 20230232621A1

(19) **United States**(12) **Patent Application Publication**

LIN et al.

(10) **Pub. No.: US 2023/0232621 A1**(43) **Pub. Date: Jul. 20, 2023**(54) **MEMORY DEVICE AND METHOD FOR MANUFACTURING THE SAME USING HARD MASK***H01L 29/786* (2006.01)*H01L 29/66* (2006.01)(52) **U.S. Cl.**CPC .. *H01L 27/11556* (2013.01); *H01L 27/11519* (2013.01); *H01L 29/41733* (2013.01); *H01L 29/78618* (2013.01); *H01L 29/66742* (2013.01)(71) Applicant: **TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY, LTD.**, Hsinchu (TW)(72) Inventors: **Meng-Han LIN**, Hsinchu (TW); **Feng-Cheng YANG**, Hsinchu (TW)(73) Assignee: **TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY, LTD.**, Hsinchu (TW)(21) Appl. No.: **17/577,788**(22) Filed: **Jan. 18, 2022****Publication Classification**(51) **Int. Cl.***H01L 27/11556* (2006.01)*H01L 27/11519* (2006.01)*H01L 29/417* (2006.01)(57) **ABSTRACT**

A semiconductor device includes an underlying substrate, two stack units disposed over the underlying substrate, and a feature disposed between the stack units. The stack units are spaced apart from each other. Each of the stack units includes a plurality of conductive films and a plurality of dielectric films disposed to alternate with the conductive films, an inter-metal dielectric (IMD) portion, and a hard mask film. An uppermost one of the dielectric films of each of the stack units is disposed over the conductive films, and has a dimension smaller than those of the conductive films and those of remaining ones of the dielectric films of each of the stack units. The feature includes a plurality of repeating units and a plurality of separators which are disposed to alternate with the repeating units. A method for manufacturing the semiconductor device is also disclosed.

