



US 20230230919A1

(19) **United States**

(12) **Patent Application Publication**

Kabir et al.

(10) **Pub. No.: US 2023/0230919 A1**

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

(54) **METAL SPACERS WITH HARD MASKS
FORMED USING A SUBTRACTIVE
PROCESS**

(52) **U.S. Cl.**
CPC *H01L 23/528* (2013.01); *H01L 23/5226*
(2013.01); *H01L 23/5228* (2013.01); *H01L*
21/76825 (2013.01)

(71) Applicant: **Intel Corporation**, Santa Clara, CA
(US)

(72) Inventors: **Nafees A. Kabir**, Hillsboro, OR (US);
Kevin L. Lin, Beaverton, OR (US)

(73) Assignee: **Intel Corporation**, Santa Clara, CA
(US)

(21) Appl. No.: **17/579,249**

(22) Filed: **Jan. 19, 2022**

Publication Classification

(51) **Int. Cl.**
H01L 23/528 (2006.01)
H01L 23/522 (2006.01)
H01L 21/768 (2006.01)

(57) **ABSTRACT**

An integrated circuit device includes a first interconnect layer, and a conductive first interconnect feature and a conductive second interconnect feature laterally separated by a body of insulating or semiconductor material. In an example, the first and second interconnect features are above the first interconnect layer. The integrated circuit device further includes a non-conductive feature above and on the first interconnect feature, and a conductive third interconnect feature above and on the second interconnect feature. The integrated circuit device also includes a second interconnect layer above the non-conductive feature and third interconnect features. In an example, the second and third interconnect features conductively couple the first and second interconnect layers.

