Investigation of pillar thickness variation effect on oblique rotating implantation (ORI)-based vertical double gate MOSFET

Abstract

The rapid scaling of integrated circuit requires further shrinkage of lateral device dimension, which correlates with pillar thickness in vertical structure. This paper investigates the effect of pillar thickness variation on vertical double gate MOSFET (VDGM) fabricated using oblique rotating ion implantation (ORI) method. For this purpose, several scenarios of silicon pillar thickness tsi were evaluated for 20100 nm channel length. The source region was found to merge at pillar thickness below 75 nm, which results in floating body effect and creates isolated region in the middle of pillar. The vertical devices using ORI method show better performance than those with conventional implantation method for all pillar thickness, due to the elimination of corner effect that degrades the gate control. The presence of isolated depletion region in the middle of pillar at floating body increases parasitic effect for higher drain potential. By further reduction of pillar thickness towards fully depleted feature, the increase in gate-to gate charge coupling improves the performance of ORI-based vertical double gate MOSFET, as evident in near-ideal swing value and lower DIBL, compared to the partially depleted and body-tied device. © 2010 Elsevier Ltd. All rights reserved.