

ABSTRACT

A semiconductor device includes a lower structure; a stack structure including gate layers and interlayer insulating layers and having an opening; a vertical structure in the opening; a contact structure on the vertical structure; and a conductive line on the contact structure. The vertical structure includes an insulating core region, a channel semiconductor layer covering side and lower surfaces of the insulating core region, data storage patterns between the channel semiconductor layer and the gate layers and spaced apart from each other, a first dielectric layer, and a second dielectric layer. At least a portion of the first dielectric layer is between the data storage patterns and the gate layers, at least a portion of the second dielectric layer is between the data storage patterns and the channel semiconductor layer, and the insulating core region includes first convex portions having increased widths in regions facing the gate layers.

FIG. 2