

ABSTRACT OF THE DISCLOSURE

A semiconductor device is disclosed. The semiconductor device includes a channel structure on a substrate and extending in a first direction perpendicular to a top surface of the substrate; a plurality of gate electrodes on the substrate and spaced apart from one another in the first direction on a sidewall of the channel structure; and a gate insulating layer between each of the plurality of gate electrodes and the channel structure, wherein the channel structure includes a body gate layer extending in the first direction; a charge storage structure surrounding a sidewall of the body gate layer; and a channel layer surrounding sidewall of the charge storage structure.

FIG. 3