

ABSTRACT

A semiconductor device includes a stack structure comprising gate electrodes, wherein the stack structure includes a first region, a second region, and a third region therebetween; an insulating layer on the stack structure; a channel structure extending into the stack structure in the first region; first contact plugs extending into the insulating layer, wherein the first contact plugs are electrically connected to the pad regions of the ones of the upper gate electrodes, respectively, in the third region; second contact plugs extending into at least one among the gate electrodes and the insulating layer, wherein ones of the second contact plugs extend to different lengths in the second region; a side-surface insulating structure extending around a side surface of each of the second contact plugs; and an upper side-surface insulating layer extending around a side surface of each of the first contact plugs.

FIG. 2A