

ABSTRACT

A semiconductor device includes a peripheral circuit structure including a first substrate and circuit elements on the first substrate; and a memory cell structure including a second substrate on the first substrate, a first horizontal conductive layer on the second substrate, a second horizontal conductive layer on the first horizontal conductive layer, gate electrodes spaced apart from each other and stacked on the second horizontal conductive layer, channel structures penetrating through the gate electrodes, and separation regions penetrating the gate electrodes, extending, and spaced apart from each other. The semiconductor device has a through-wiring region including a through-contact plug electrically connecting the memory cell structure and the peripheral circuit structure, the separation regions include first separation regions adjacent to the through-contact plug, and the first separation regions penetrate through the second horizontal conductive layer and are spaced apart from the first horizontal conductive layer.

FIG. 1