

ABSTRACT

A semiconductor device includes a transistor on a substrate, a first wiring structure on and electrically connected to the transistor, an insulation pattern extending through the substrate, a second wiring structure under the substrate, a plurality of through vias in the insulation pattern and spaced apart from each other in a horizontal direction, extending through the insulation pattern and contacting a portion of each of the first and second wiring structures, a bit line structure under and electrically connected to the second wiring structure, a gate electrode under the bit line structure and electrically connected to the second wiring structure, a channel adjacent to the gate electrode and contacts the bit line structure, and a capacitor under and electrically connected to the channel.

FIG. 1