

ABSTRACT

SEMICONDUCTOR DEVICE

To provide a semiconductor device that includes an oxide semiconductor and is miniaturized while keeping good electrical properties. In the semiconductor device, an oxide semiconductor layer is surrounded by an insulating layer including an aluminum oxide film containing excess oxygen. Excess oxygen in the aluminum oxide film is supplied to the oxide semiconductor layer including a channel by heat treatment in a manufacturing process of the semiconductor device. Furthermore, the aluminum oxide film forms a barrier against oxygen and hydrogen. It is thus possible to suppress the removal of oxygen from the oxide semiconductor layer surrounded by the insulating layer including an aluminum oxide film, and the entry of impurities such as hydrogen into the oxide semiconductor layer; as a result, the oxide semiconductor layer can be made highly intrinsic. In addition, gate electrode layers over and under the oxide semiconductor layer control the threshold voltage effectively.

Fig. 1C