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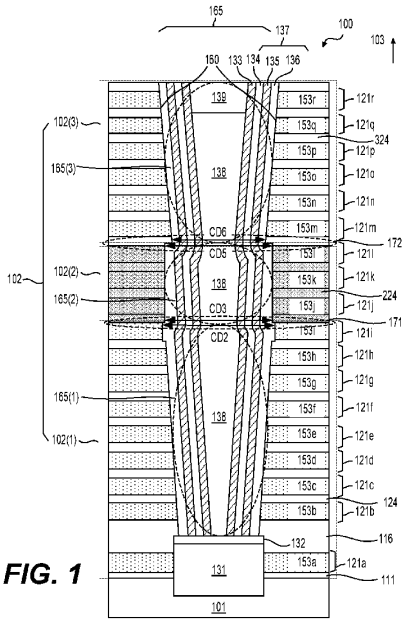


FIG. 1

(57) Abstract: A semiconductor device (100) and a method to manufacture the semiconductor device (100) are provided. The semiconductor device (100) includes a string of transistors (102) stacked in a vertical direction (103) over a substrate (101) of the semiconductor device (100) having a channel structure (165) extending in the vertical direction (103). The string of transistors (102) includes first, second, and third substrings (102(1), 102(2), 102(3)) of transistors that are arranged along first, second, and third portions (165(1), 165(2), 165(3)) of the channel structure (165), respectively. Gate structures (153b-153q) of transistors in the first, second, and third substring (102(1), 102(2), 102(3)) are separated by respective first, second, and third insulating layers (124, 224, 324) and the second insulating layers (224) have a higher etch rate than that of the third insulating layers (324).

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