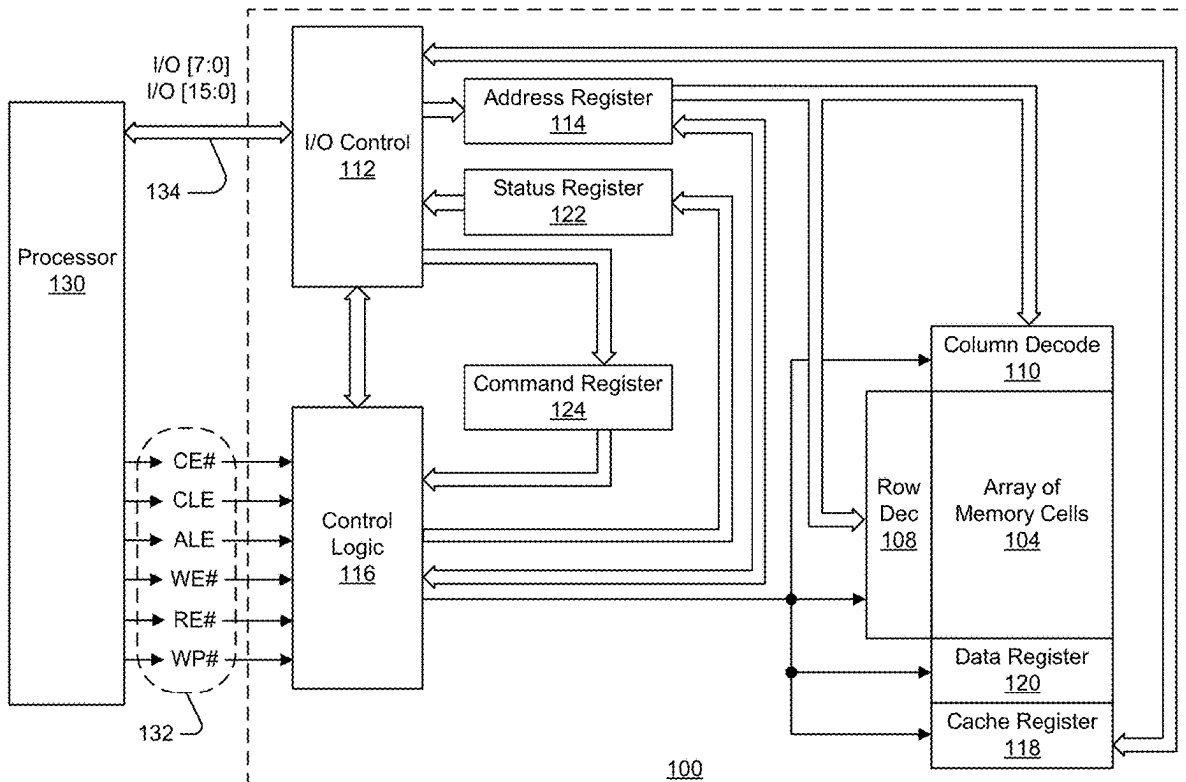


(19) **United States**(12) **Patent Application Publication****Liu et al.**(10) **Pub. No.: US 2025/0267860 A1**(43) **Pub. Date: Aug. 21, 2025**(54) **APPARATUS HAVING TRANSISTORS WITH
RAISED EXTENSION REGIONS AND
SEMICONDUCTOR FINS****H10B 43/27** (2023.01)**H10D 30/62** (2025.01)**H10D 84/83** (2025.01)(71) Applicant: **MICRON TECHNOLOGY, INC.,**
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ABSTRACT(73) Assignee: **MICRON TECHNOLOGY, INC.,**
BOISE, ID (US)(21) Appl. No.: **19/199,830**(22) Filed: **May 6, 2025****Related U.S. Application Data**(62) Division of application No. 17/110,439, filed on Dec.
3, 2020, now Pat. No. 12,310,010.**Publication Classification**(51) **Int. Cl.****H10B 41/27** (2023.01)**G11C 16/04** (2006.01)

Apparatus having a transistor connected between a voltage node and a load node, where the transistor includes a dielectric material overlying a semiconductor material including fins and having a first conductivity type, a conductor overlying the dielectric material, first and second extension region bases formed in the semiconductor material and having a second conductivity type, first and second extension region risers formed overlying respective first and second extension region bases and having the second conductivity type, and first and second source/drain regions formed in respective first and second extension region risers and having the second conductivity type at greater conductivity levels than their respective extension region risers.



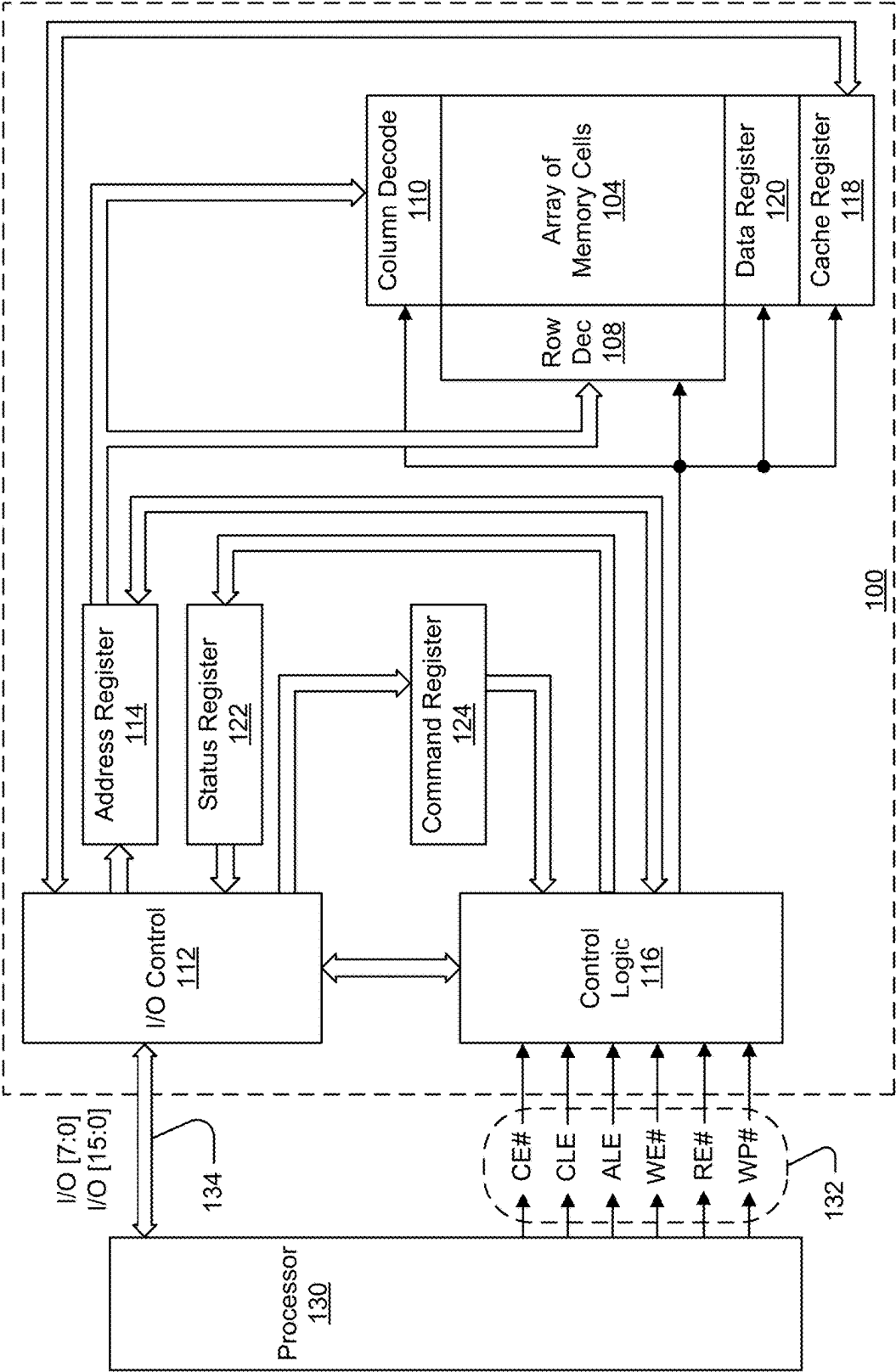


FIG. 1

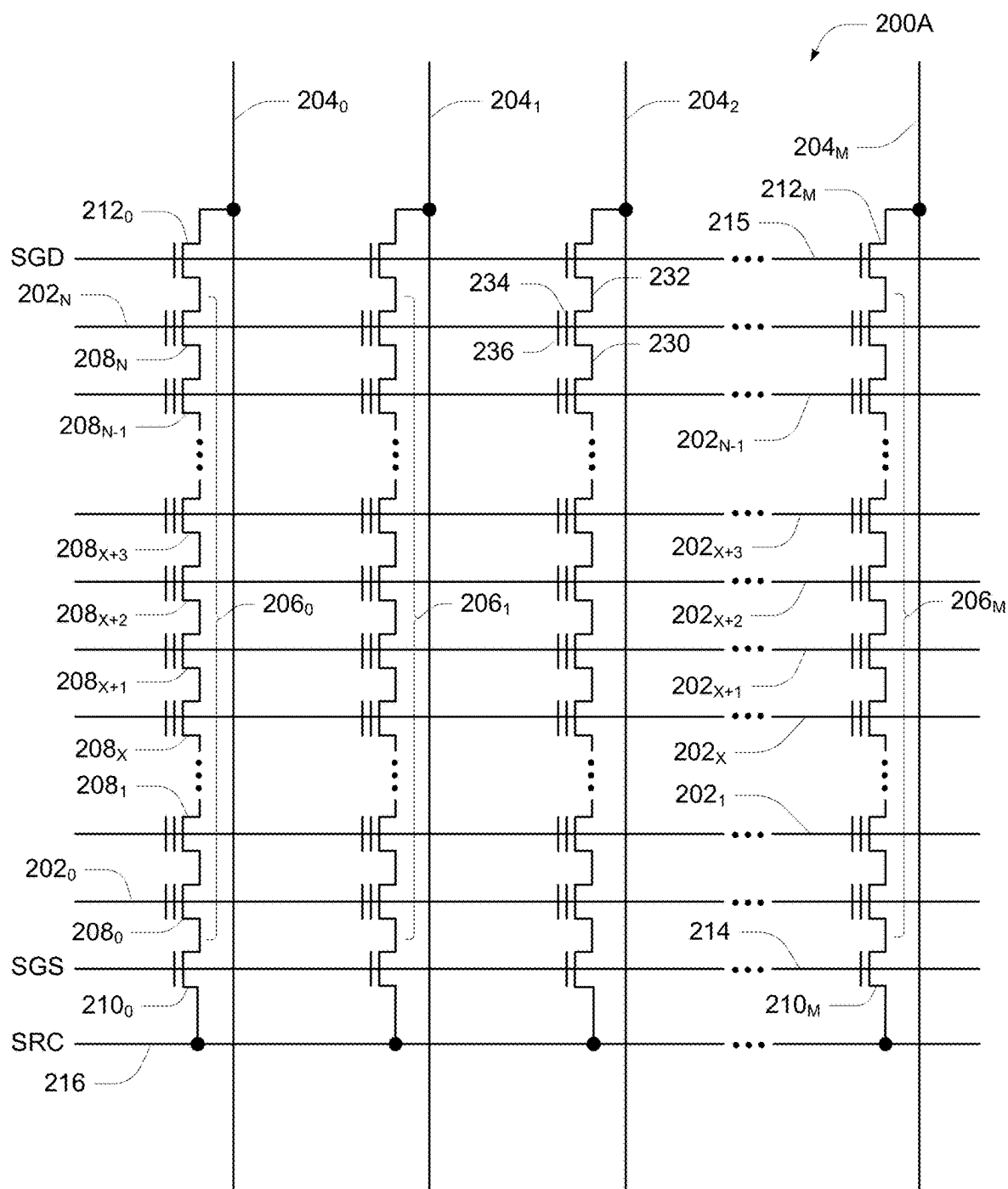


FIG. 2A

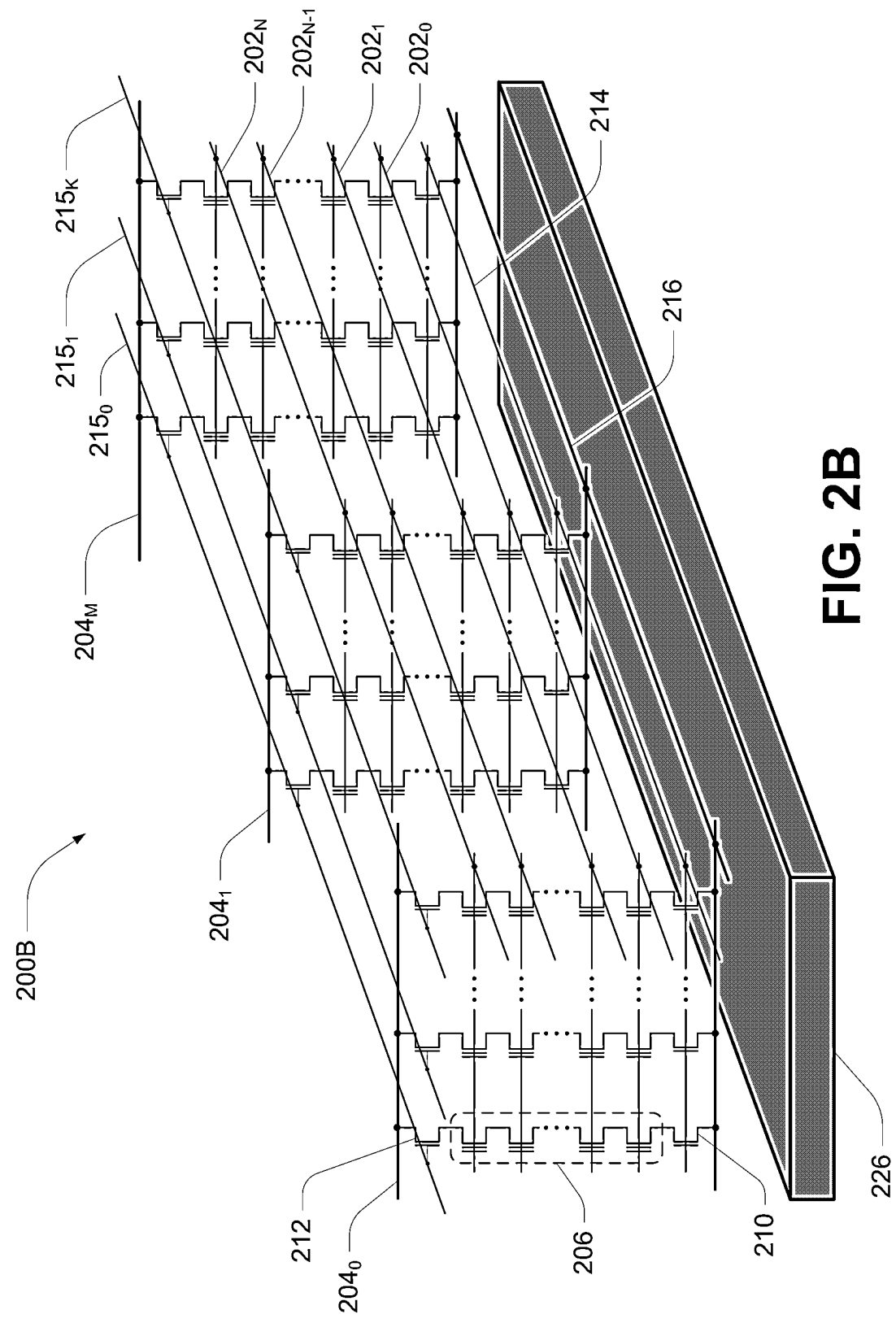


FIG. 2B

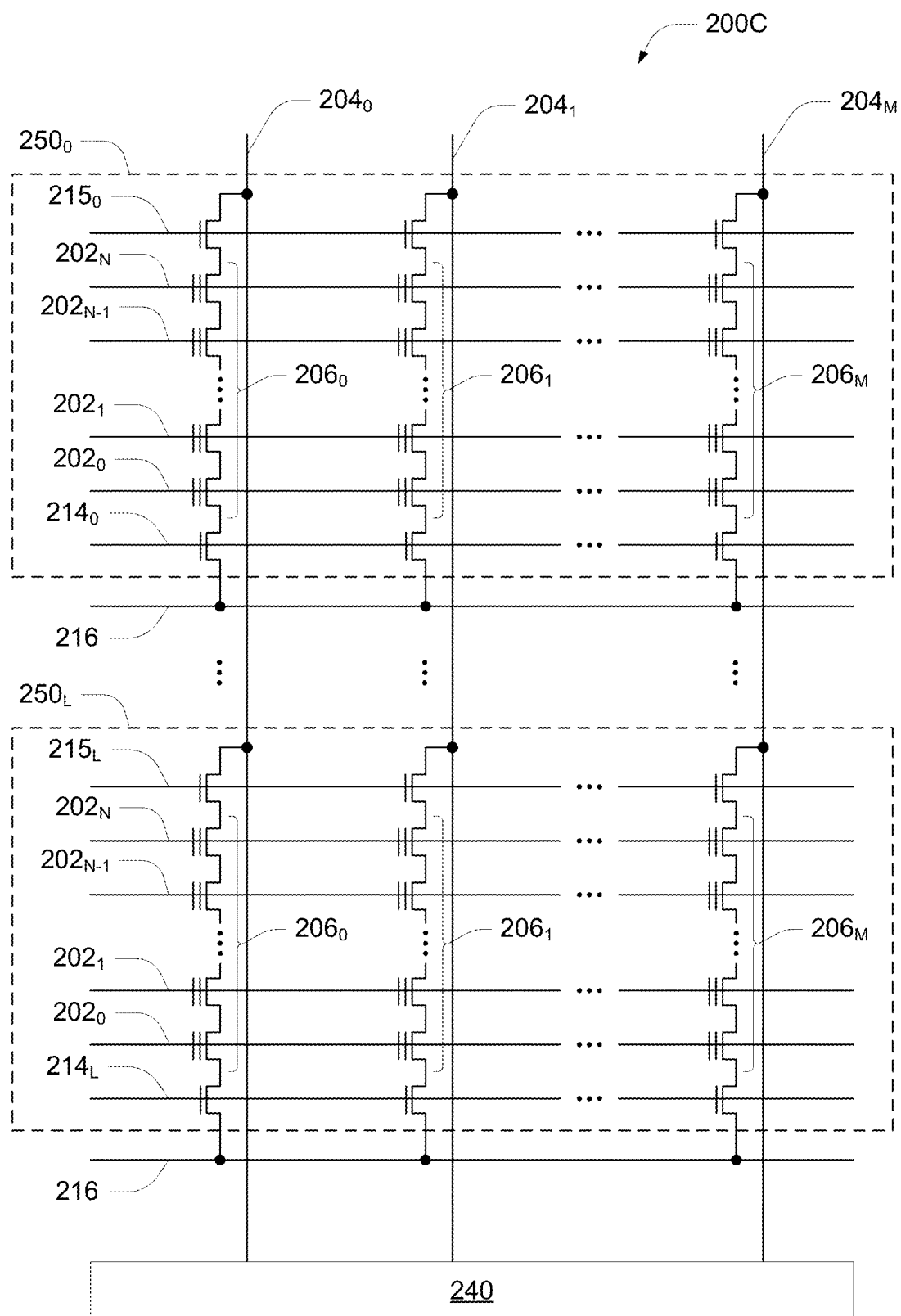


FIG. 2C

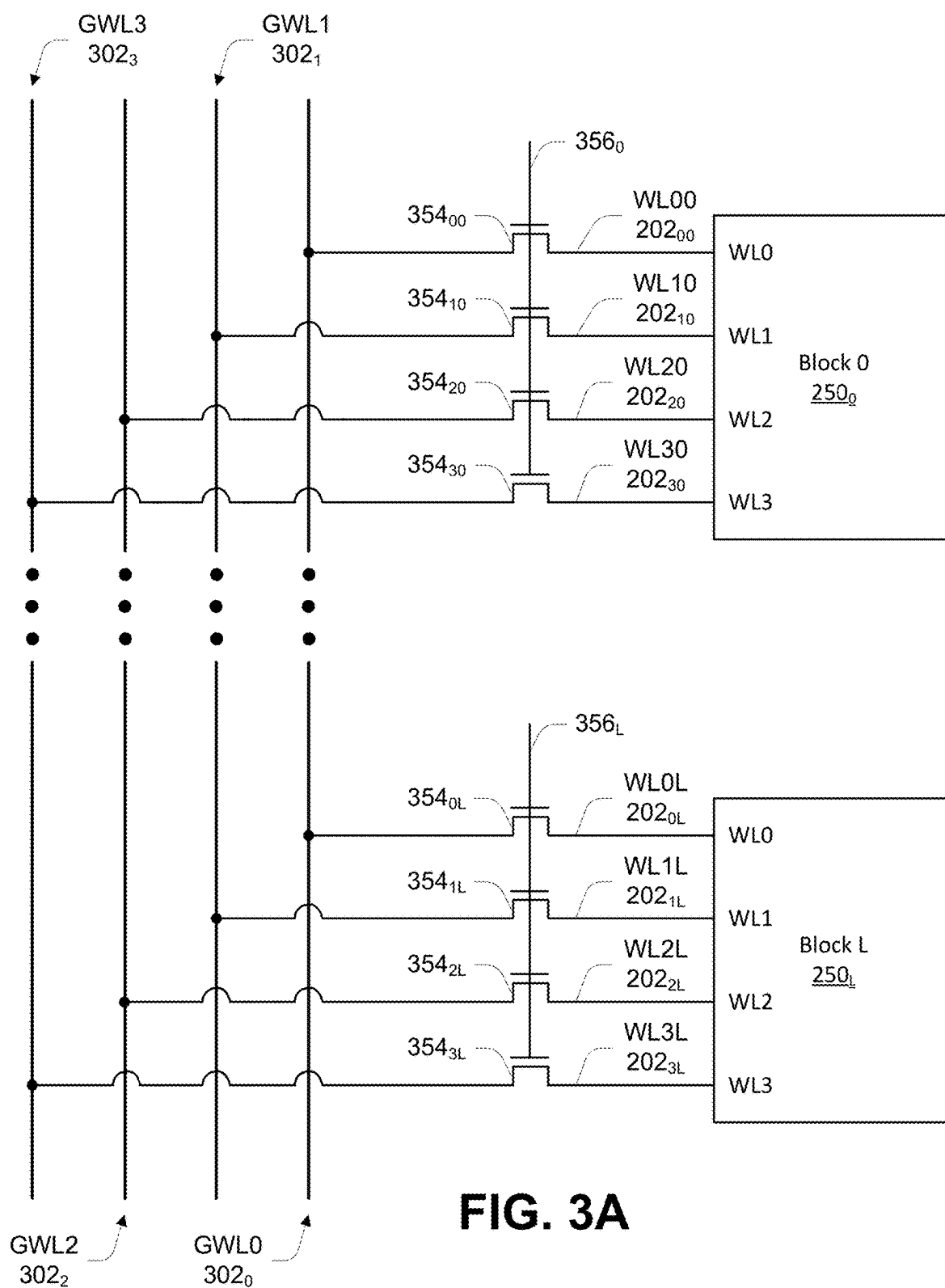


FIG. 3A

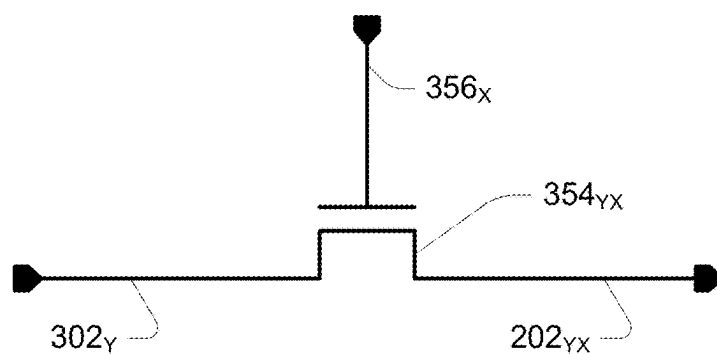


FIG. 3B

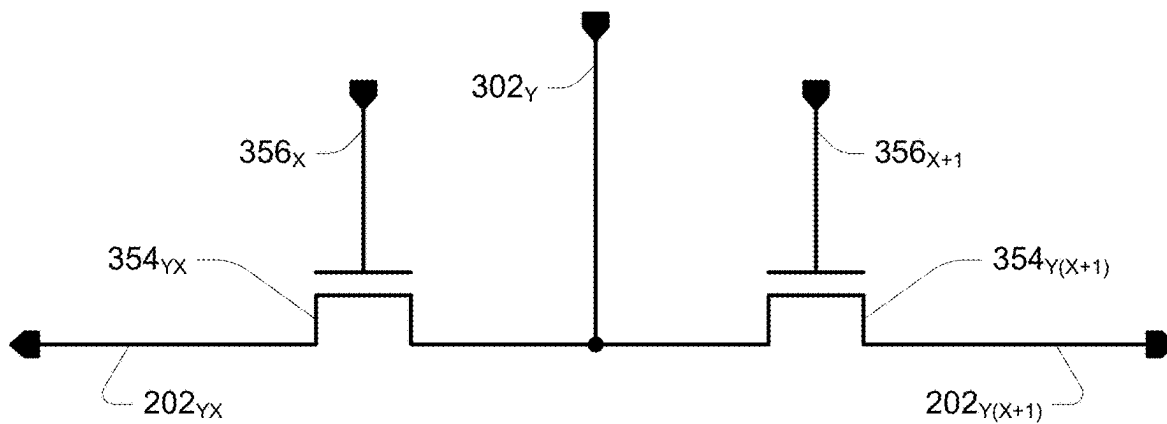


FIG. 3C

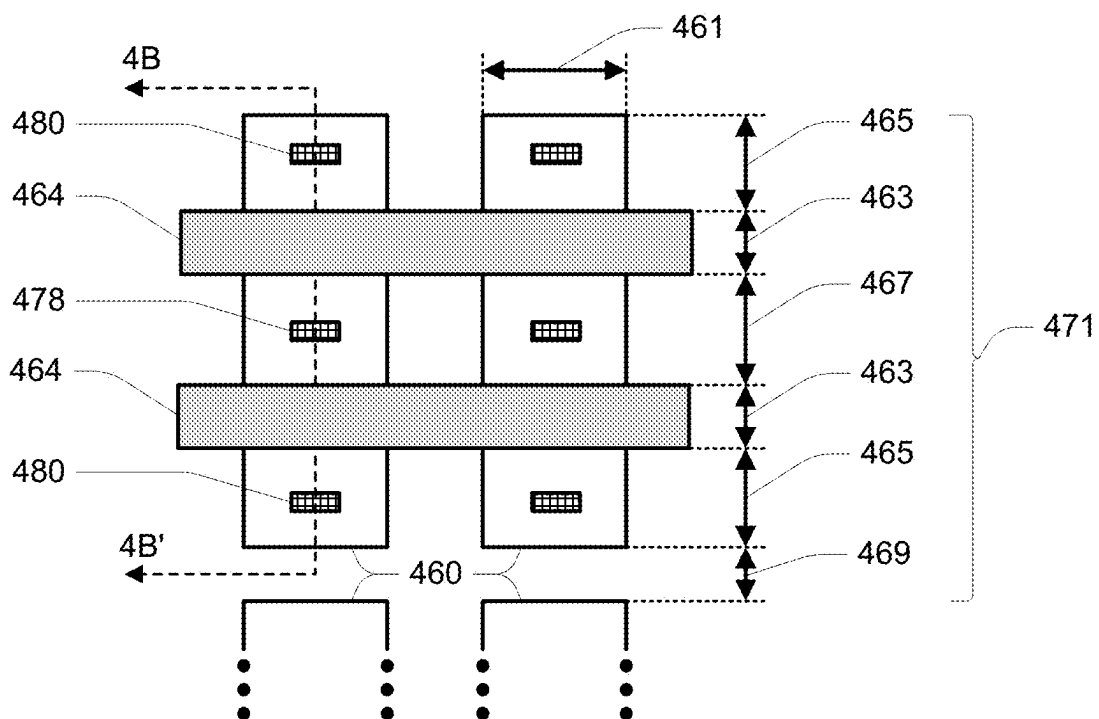


FIG. 4A
Related Art

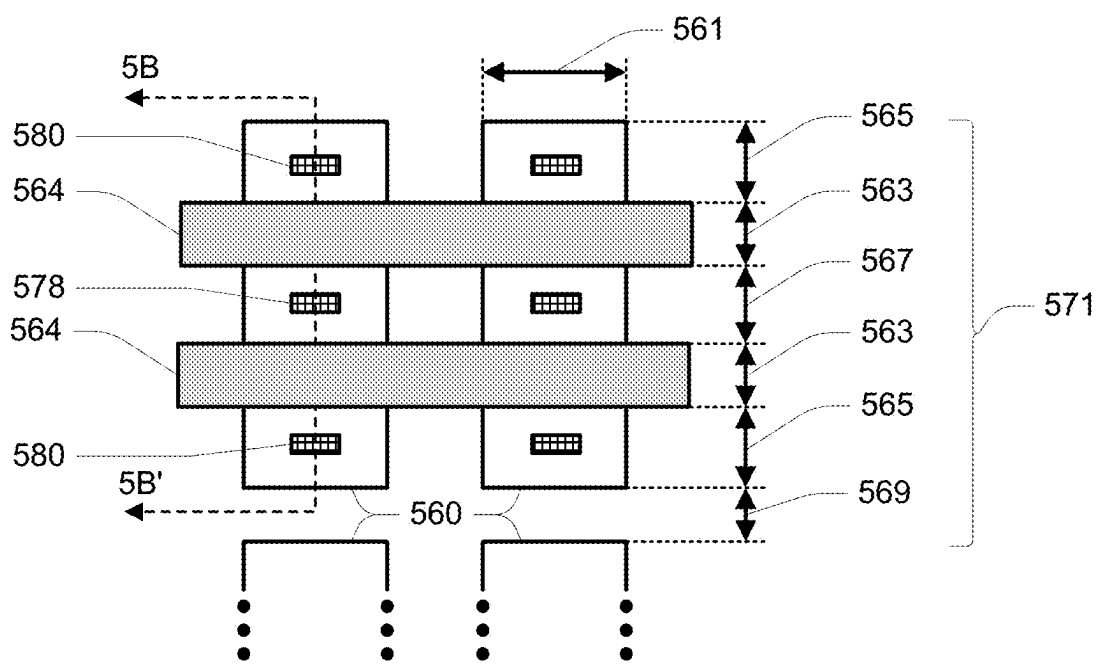


FIG. 5A

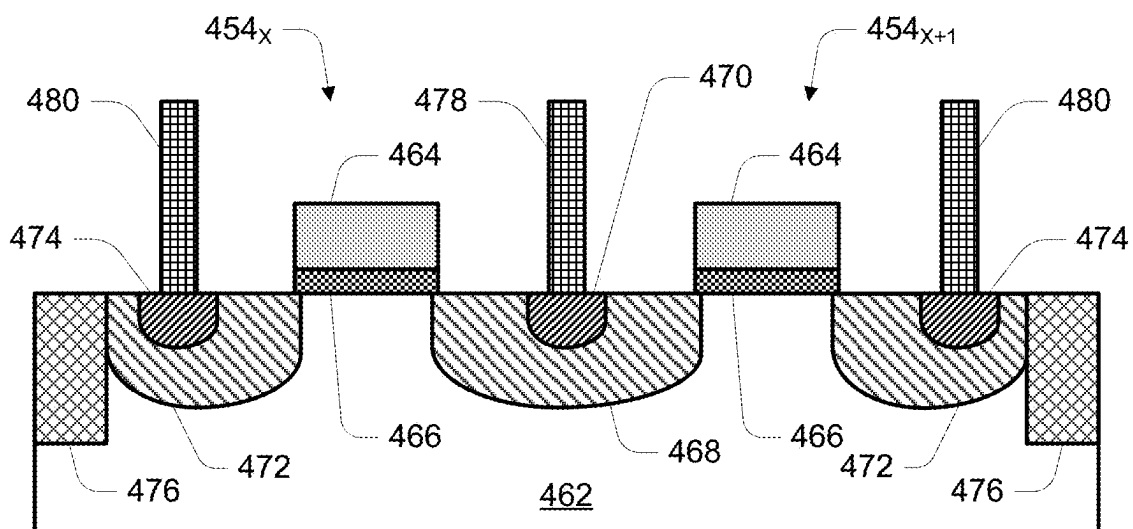


FIG. 4B
Related Art

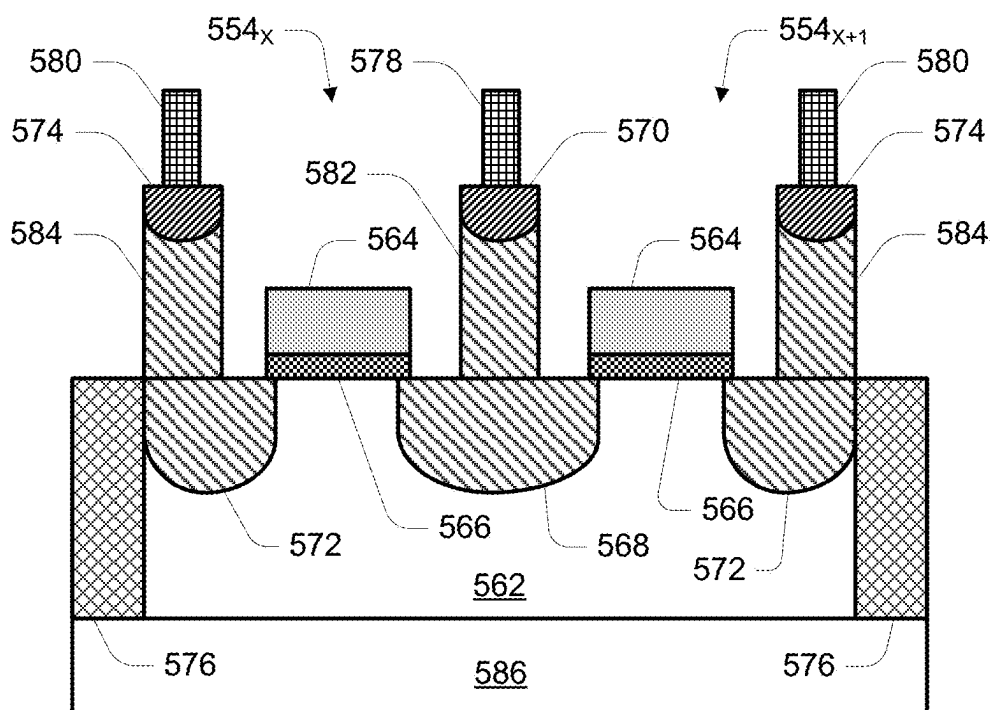


FIG. 5B

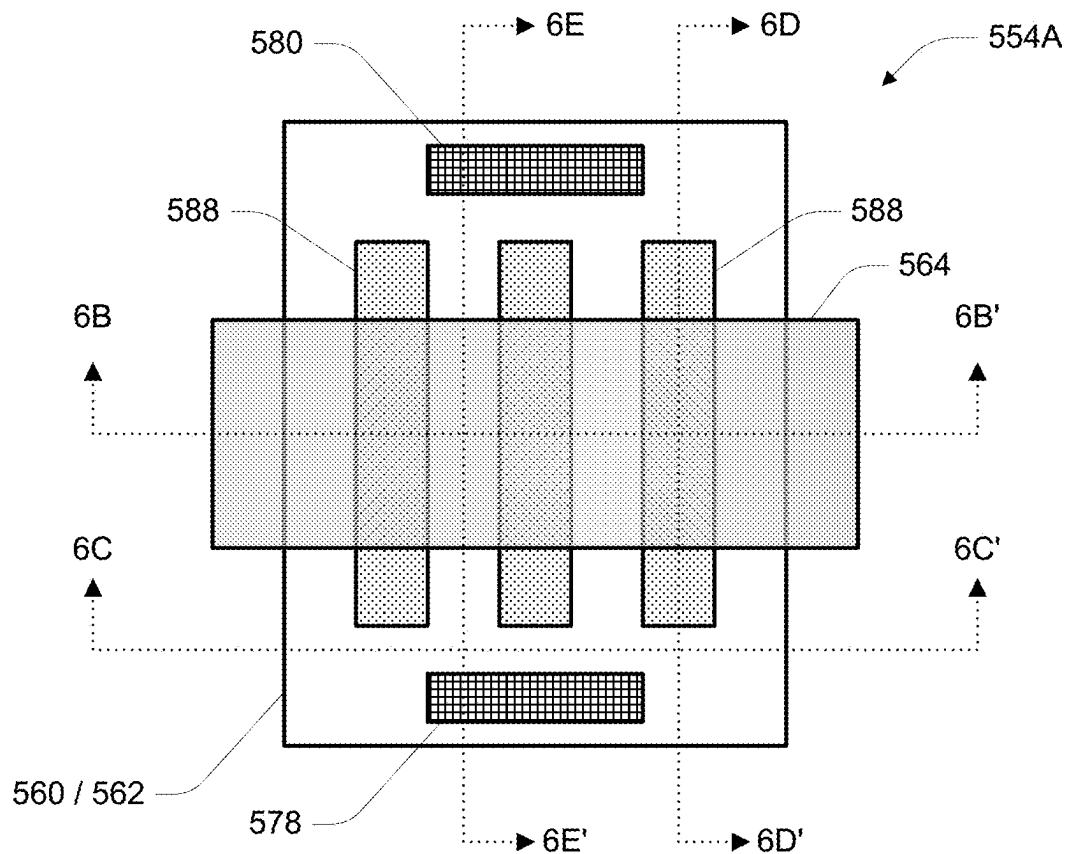


FIG. 6A

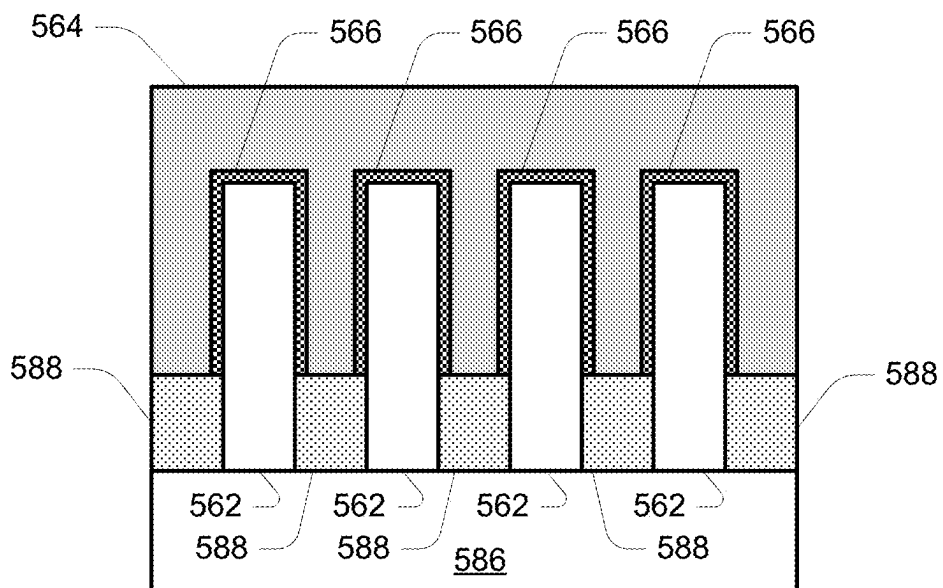


FIG. 6B

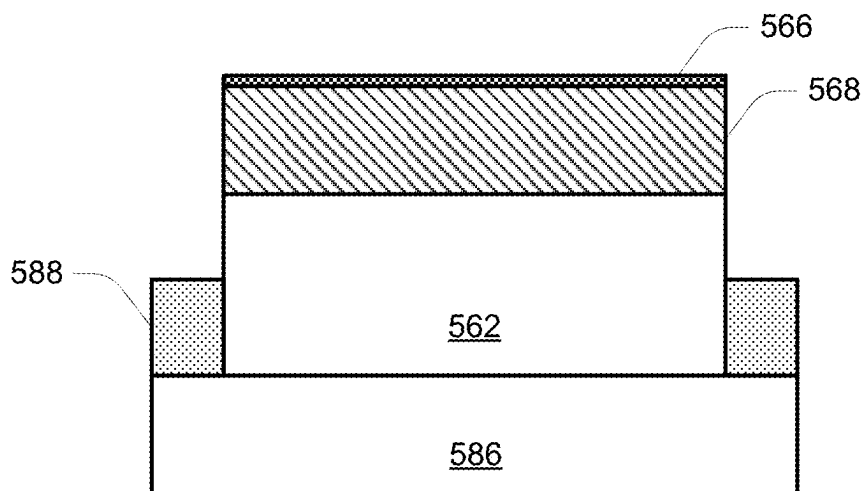


FIG. 6C

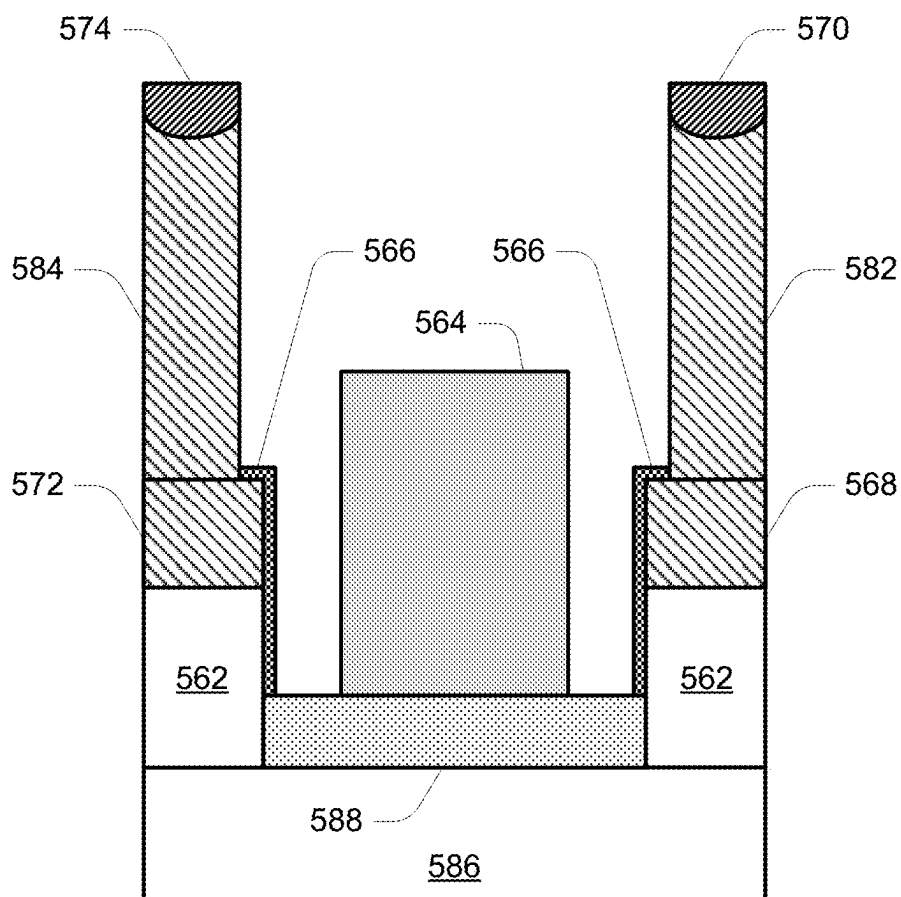


FIG. 6D

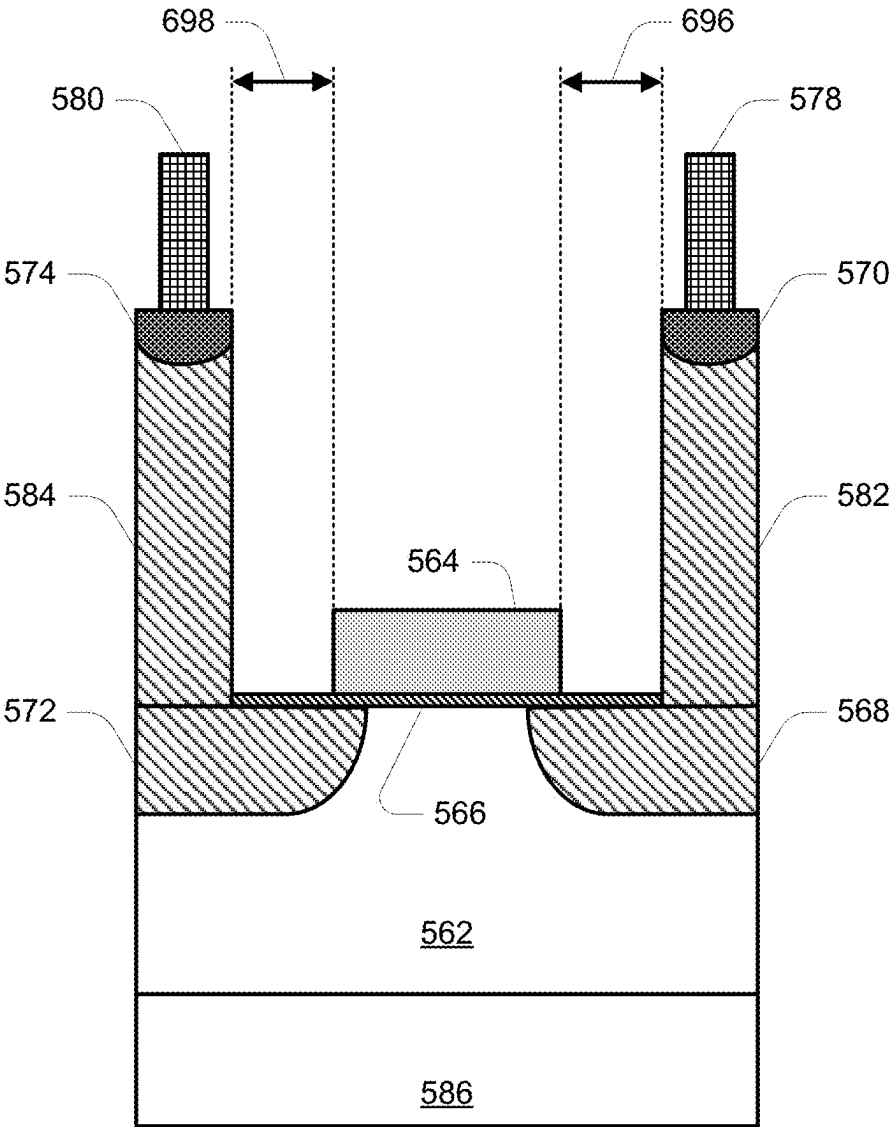


FIG. 6E

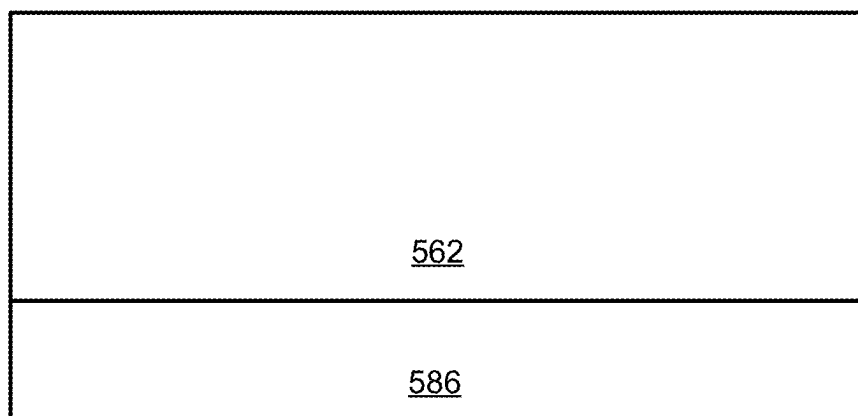


FIG. 7A

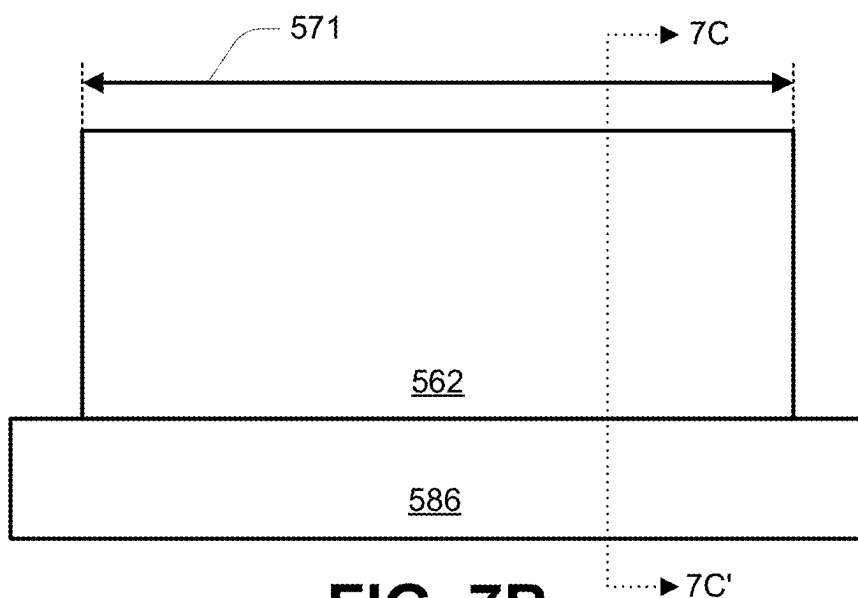


FIG. 7B

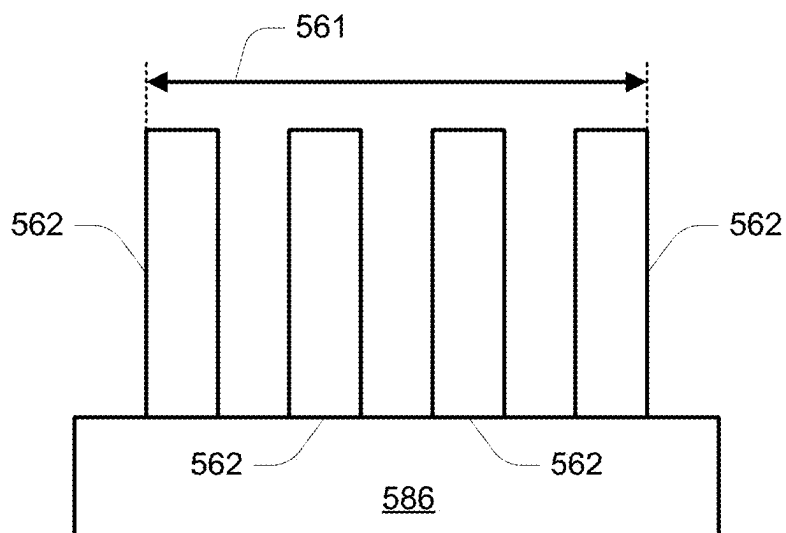


FIG. 7C

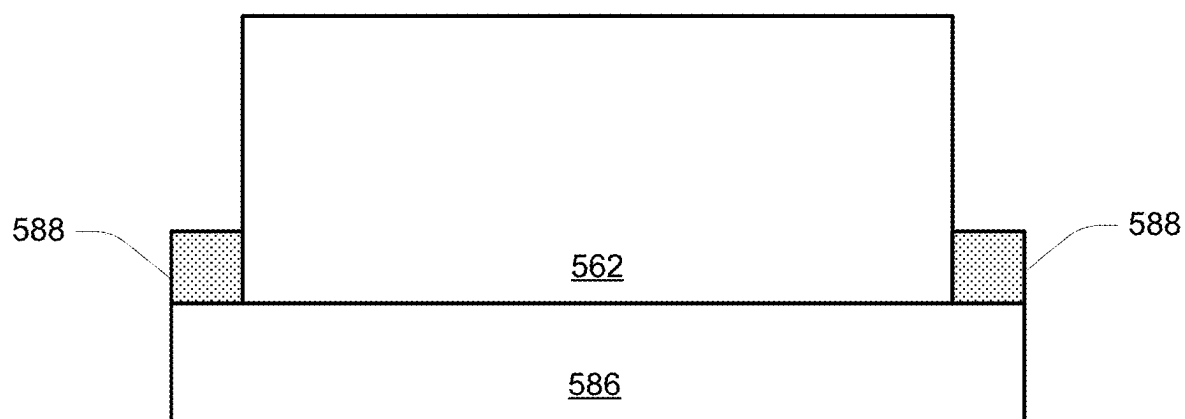


FIG. 7D

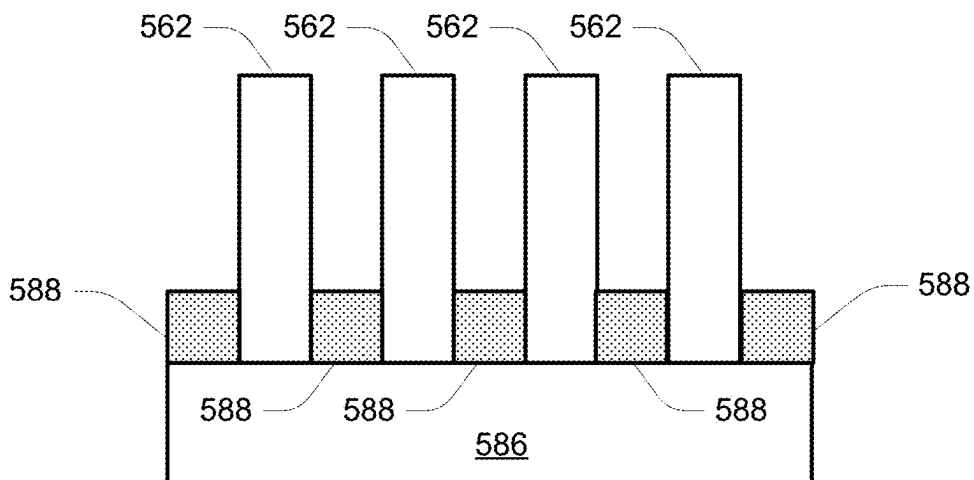


FIG. 7E

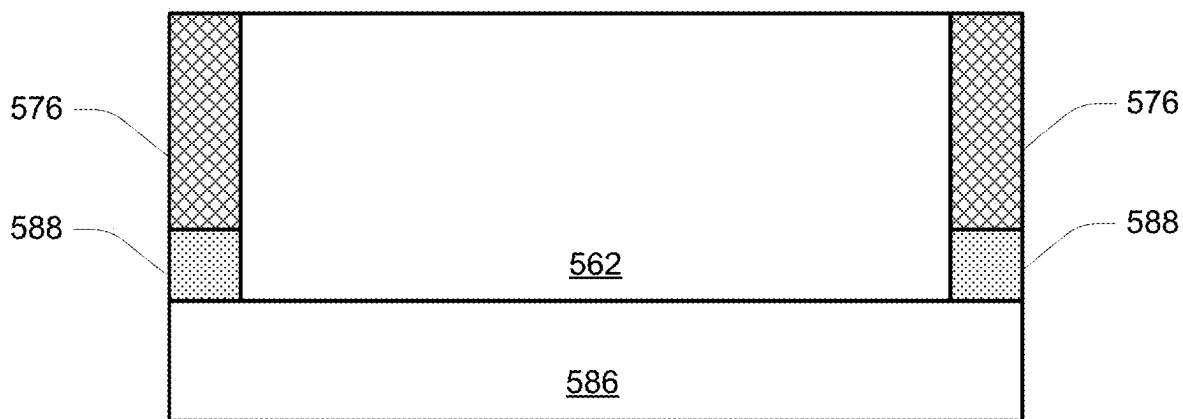


FIG. 7F

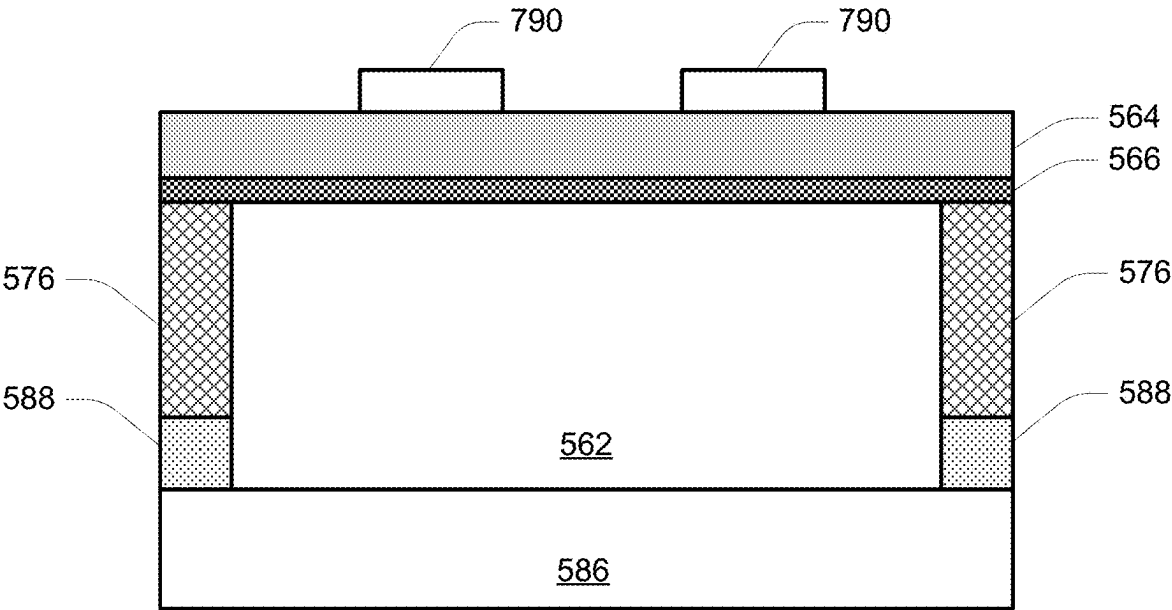


FIG. 7G

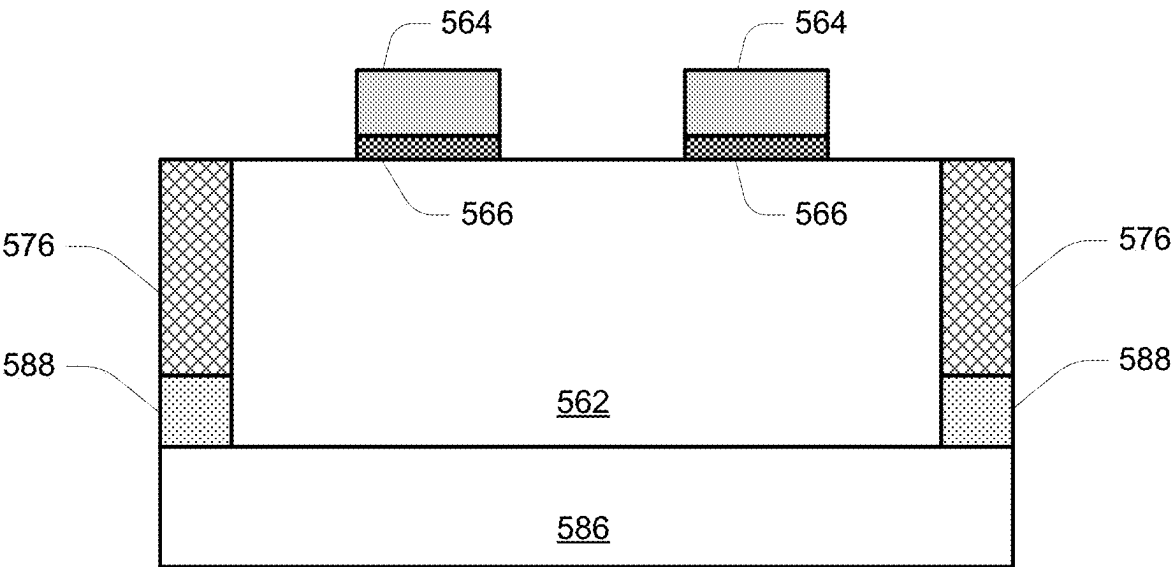


FIG. 7H

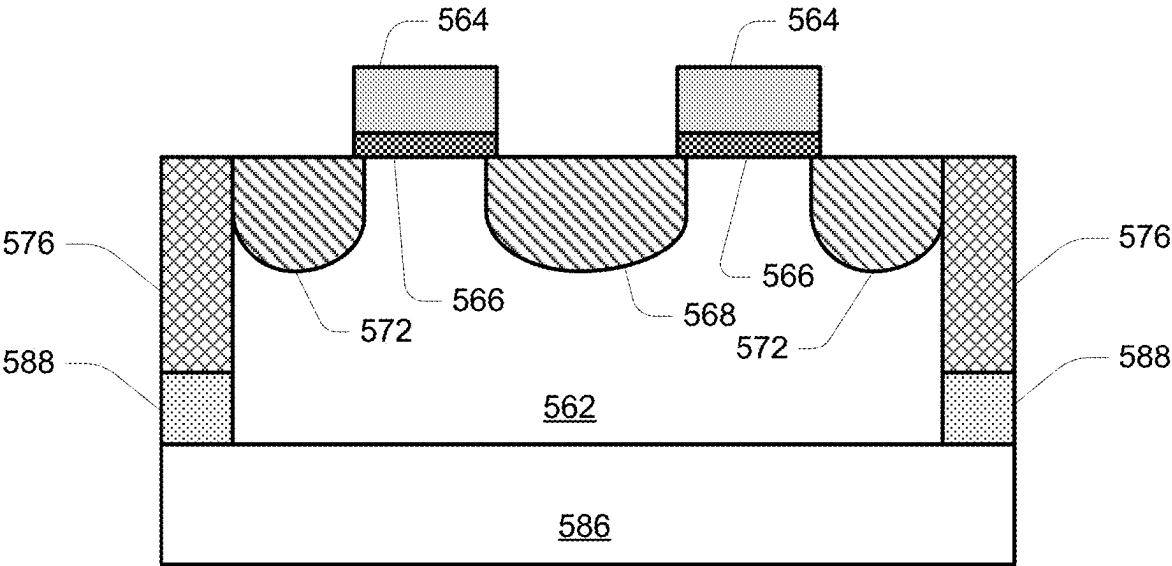


FIG. 7I

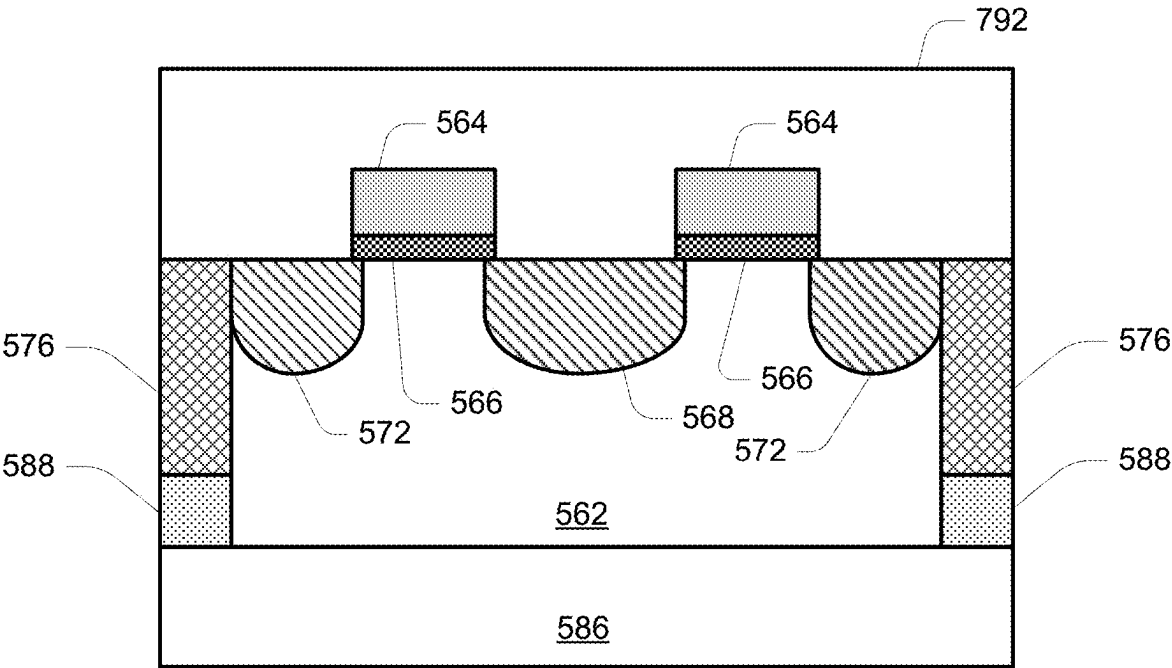


FIG. 7J

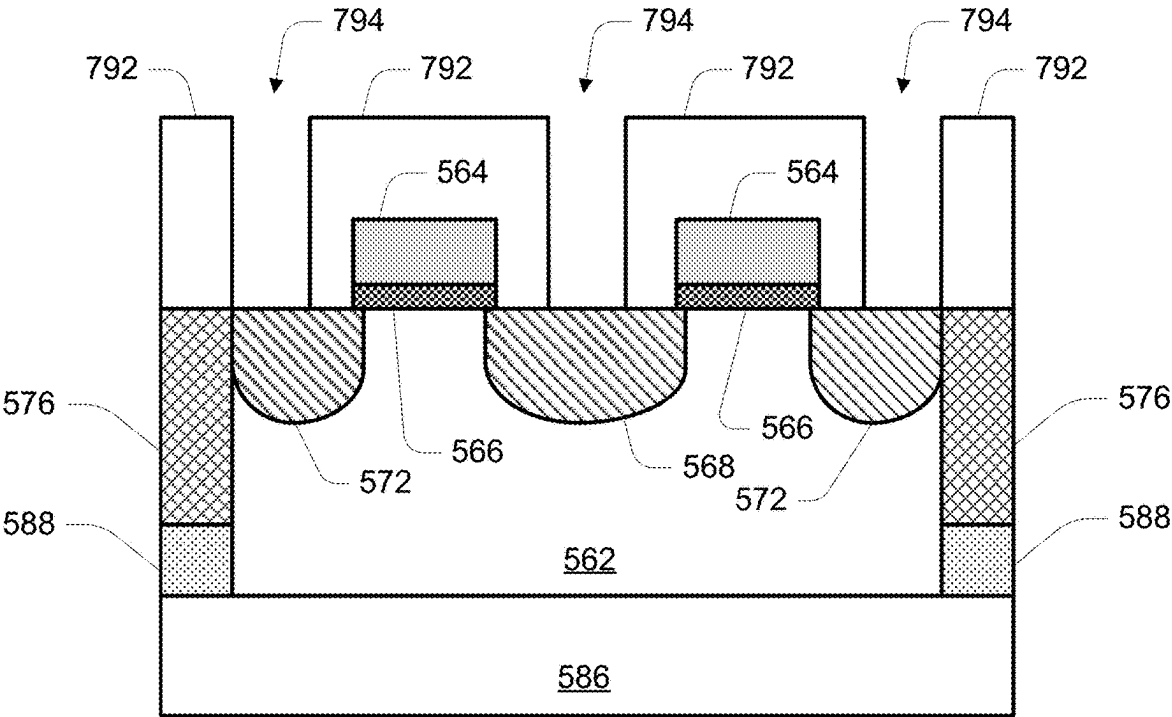


FIG. 7K

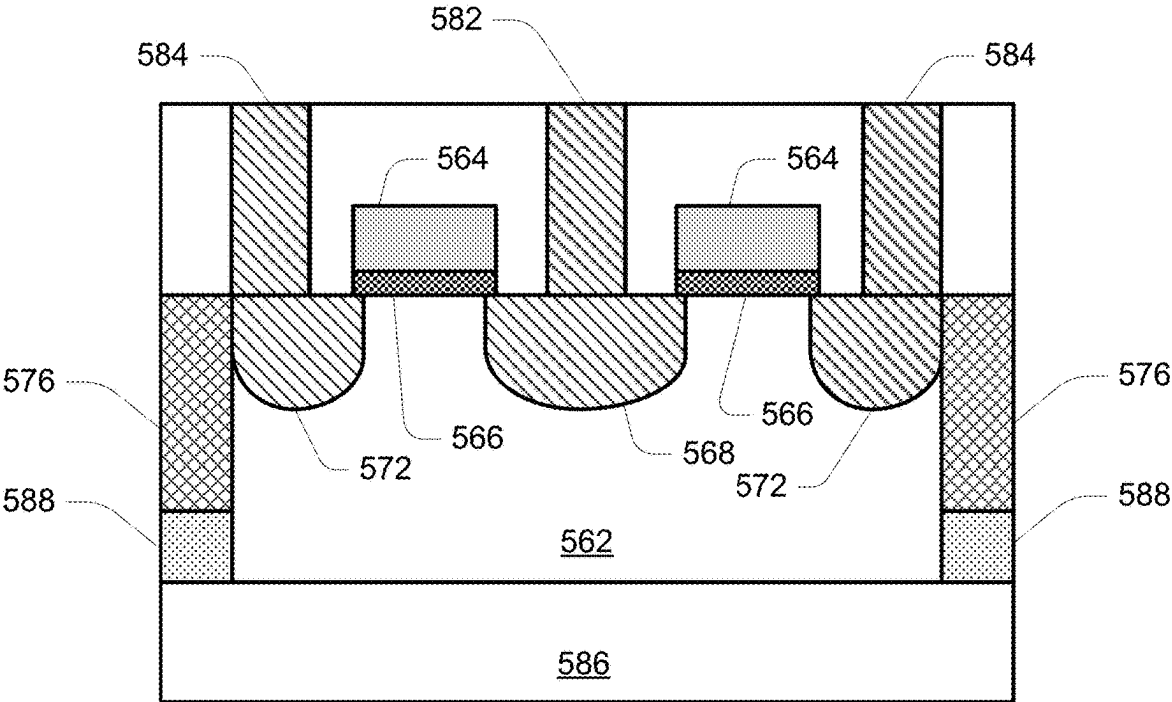


FIG. 7L

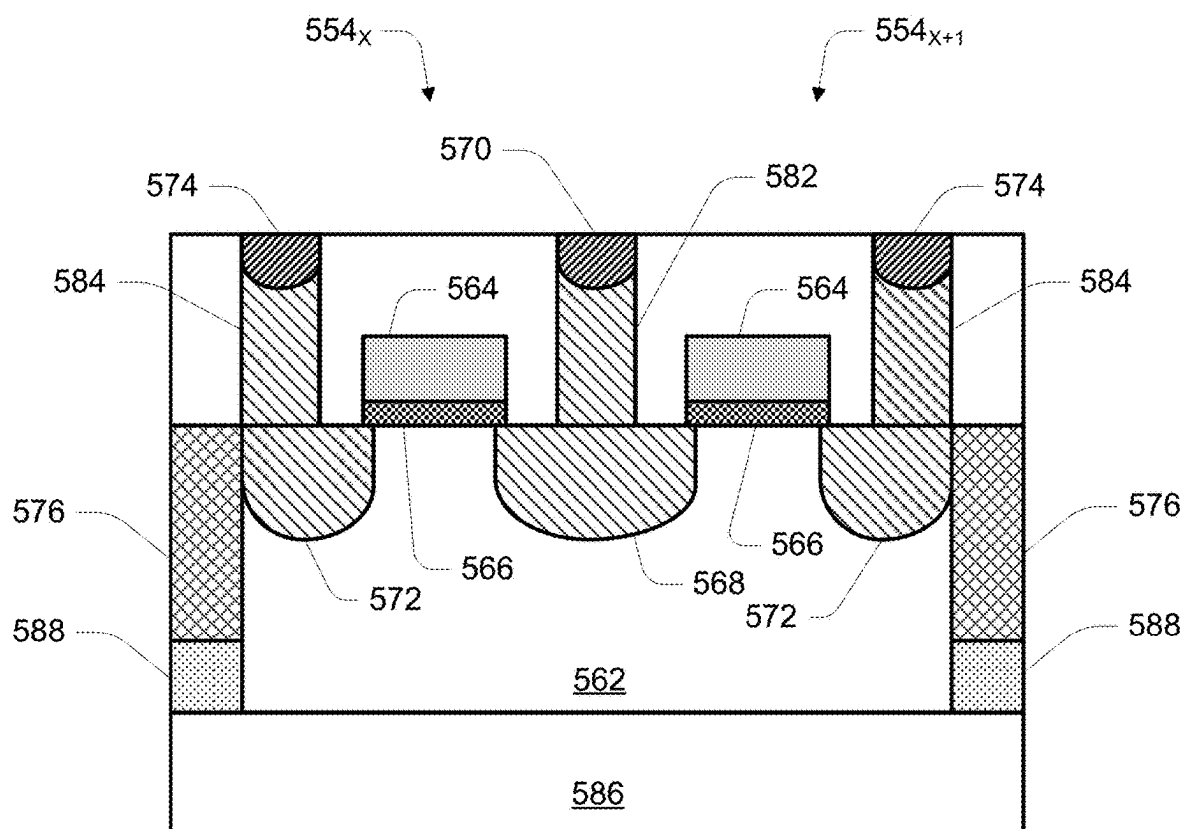


FIG. 7M

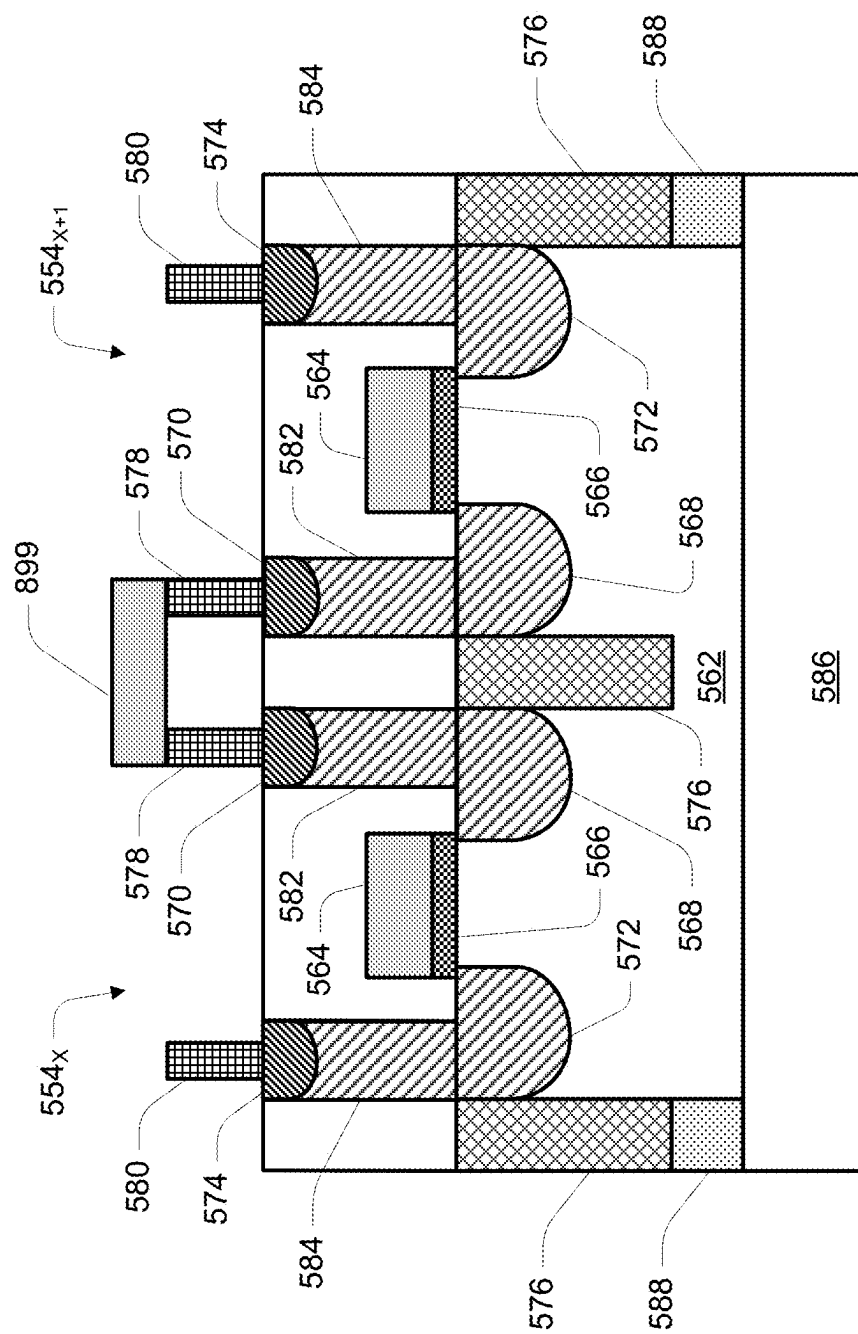


FIG. 8B

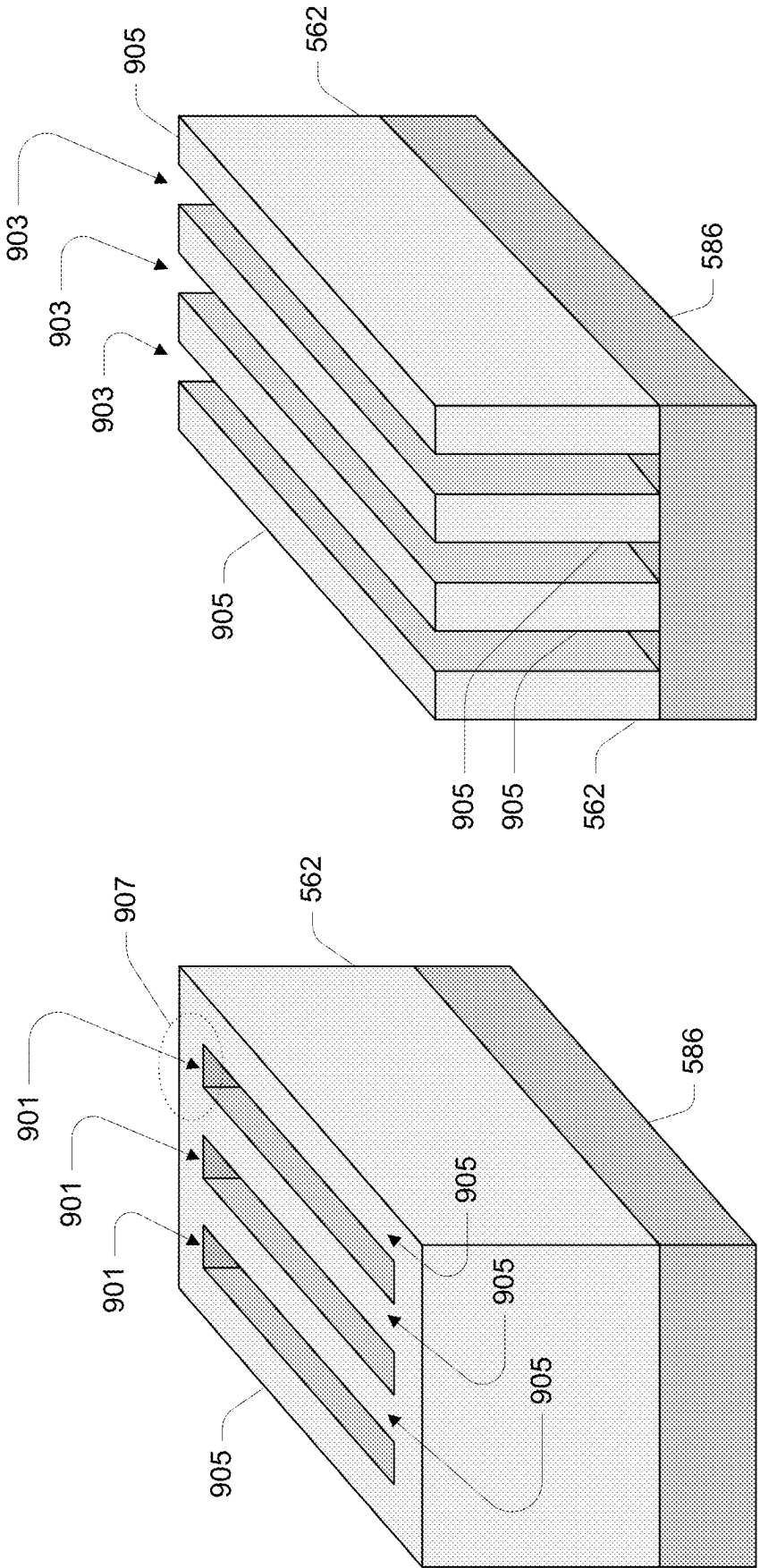


FIG. 9B

FIG. 9A

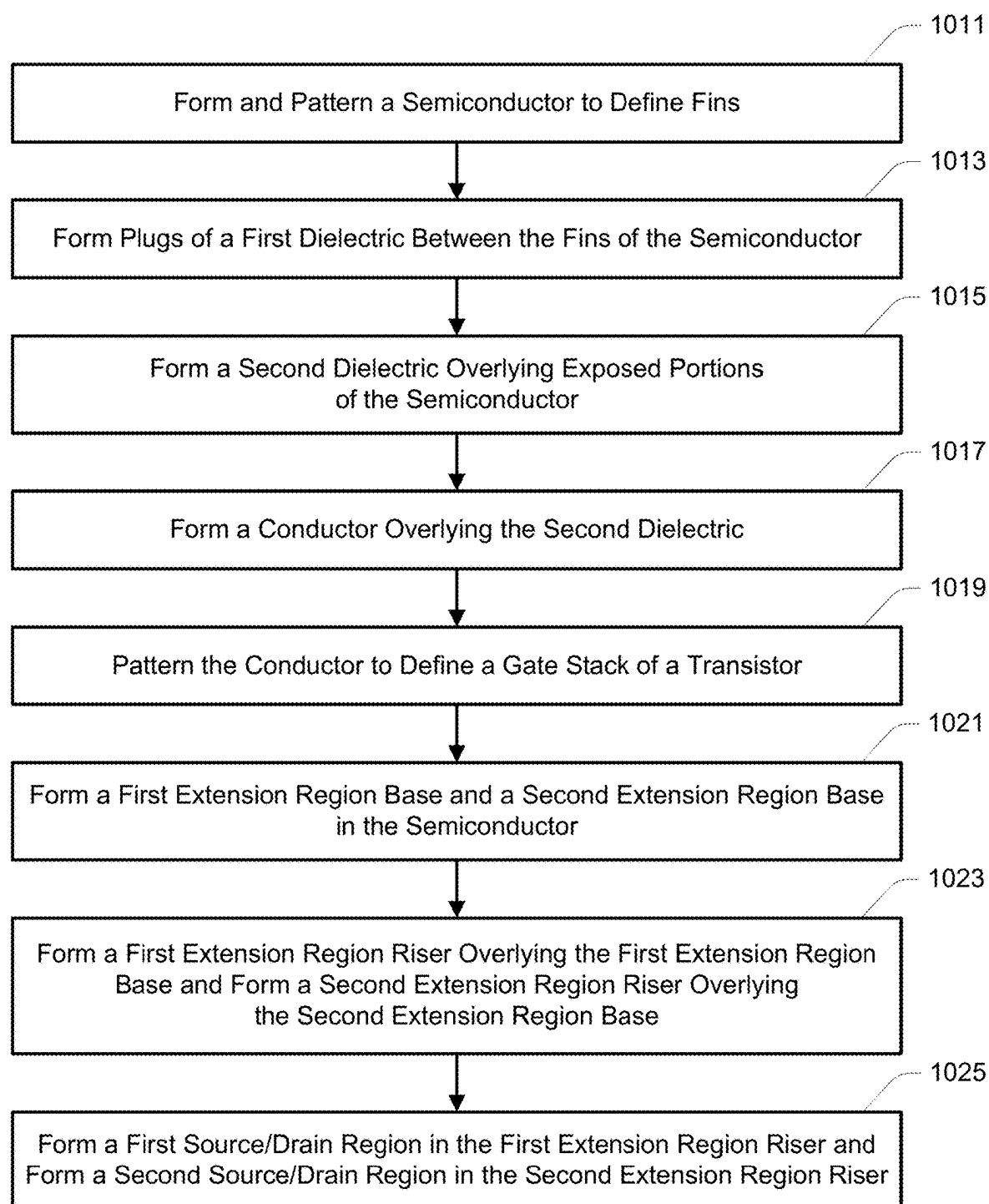


FIG. 10

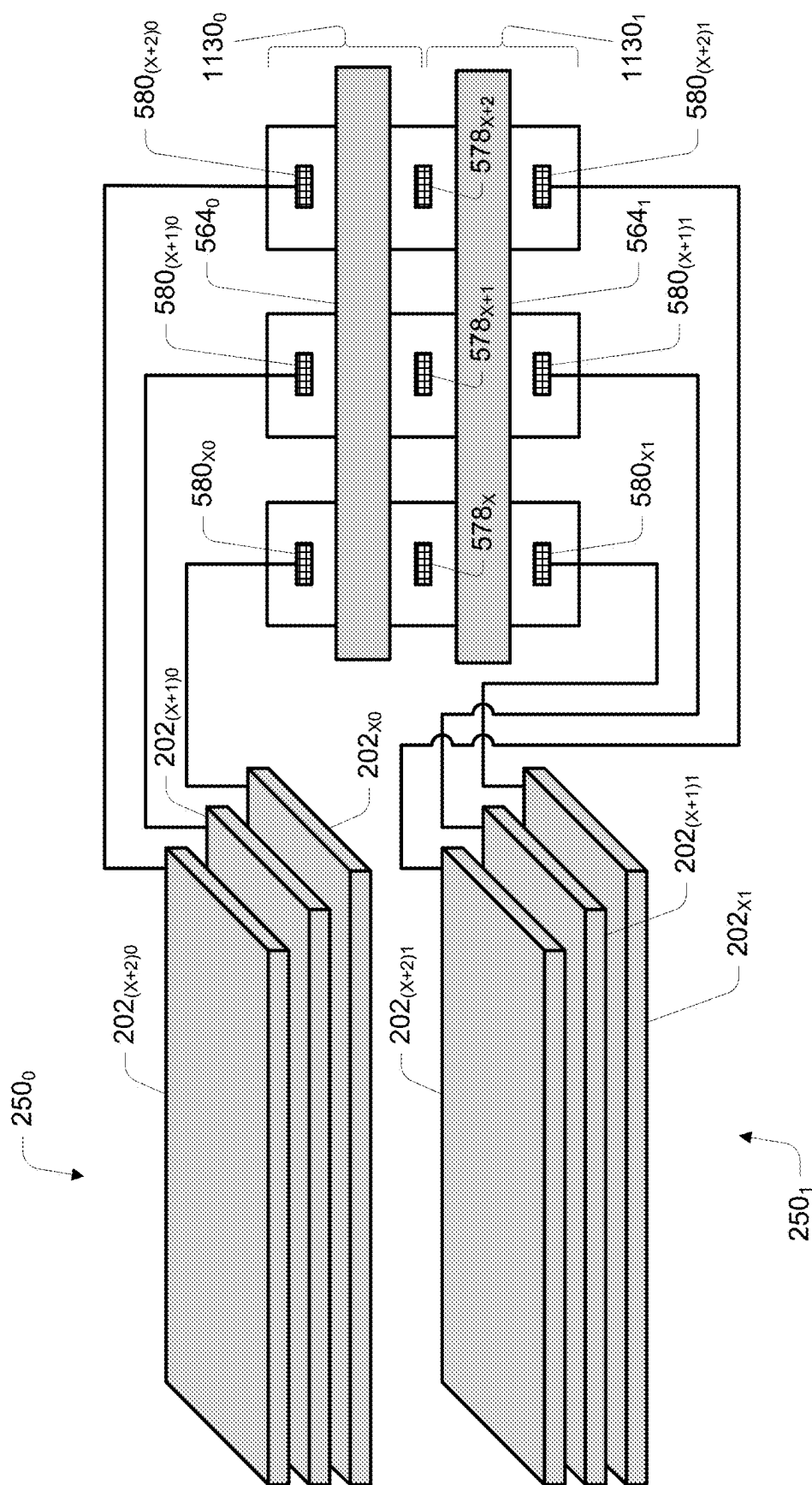


FIG. 11

APPARATUS HAVING TRANSISTORS WITH RAISED EXTENSION REGIONS AND SEMICONDUCTOR FINS

RELATED APPLICATION

[0001] This Application is a Divisional of U.S. application Ser. No. 17/110,439, titled “TRANSISTORS WITH RAISED EXTENSION REGIONS AND SEMICONDUCTOR FINS,” filed Dec. 3, 2020, (Allowed) which is commonly assigned and incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates generally to integrated circuits and, in particular, in one or more embodiments, the present disclosure relates to transistors with raised extension regions and semiconductor fins, as well as apparatus containing such transistors and methods of forming such transistors.

BACKGROUND

[0003] Integrated circuit devices traverse a broad range of electronic devices. One particular type include memory devices, oftentimes referred to simply as memory. Memory devices are typically provided as internal, semiconductor, integrated circuit devices in computers or other electronic devices. There are many different types of memory including random-access memory (RAM), read only memory (ROM), dynamic random access memory (DRAM), synchronous dynamic random access memory (SDRAM), and flash memory.

[0004] Flash memory has developed into a popular source of non-volatile memory for a wide range of electronic applications. Flash memory typically use a one-transistor memory cell that allows for high memory densities, high reliability, and low power consumption. Changes in threshold voltage (V_t) of the memory cells, through programming (which is often referred to as writing) of charge storage structures (e.g., floating gates or charge traps) or other physical phenomena (e.g., phase change or polarization), determine the data state (e.g., data value) of each memory cell. Common uses for flash memory and other non-volatile memory include personal computers, personal digital assistants (PDAs), digital cameras, digital media players, digital recorders, games, appliances, vehicles, wireless devices, mobile telephones, and removable memory modules, and the uses for non-volatile memory continue to expand.

[0005] A NAND flash memory is a common type of flash memory device, so called for the logical form in which the basic memory cell configuration is arranged. Typically, the array of memory cells for NAND flash memory is arranged such that the control gate of each memory cell of a row of the array is connected together to form an access line, such as a word line. Columns of the array include strings (often termed NAND strings) of memory cells connected together in series between a pair of select gates, e.g., a source select transistor and a drain select transistor. Each source select transistor might be connected to a source, while each drain select transistor might be connected to a data line, such as a column bit line. Variations using more than one select gate between a string of memory cells and the source, and/or between the string of memory cells and the data line, are known.

[0006] In a memory device, access of memory cells (e.g., programming memory cells) often utilizes high voltage levels delivered to the control gates of those memory cells, which might exceed 20V. Gating such voltage levels often relies on transistors, such as field-effect transistors (FETs), having high breakdown voltages. One technique for creating transistors with high breakdown voltages uses a lightly-doped region between a source/drain region and the control gate of the transistor. This region is sometimes referred to as an extension region. Such transistors often require relatively high levels of surface area of a substrate on which an integrated circuit device is fabricated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a simplified block diagram of a memory in communication with a processor as part of an electronic system, according to an embodiment.

[0008] FIGS. 2A-2C are schematics of portions of an array of memory cells as could be used in a memory of the type described with reference to FIG. 1.

[0009] FIG. 3A is a schematic of a portion of an array of memory cells and string drivers as could be used in a memory device of the type described with reference to FIG. 1.

[0010] FIG. 3B is a schematic of a portion of one example of a string driver as could be used in a memory of the type described with reference to FIG. 1.

[0011] FIG. 3C is a schematic of a portion of another example of a string driver as could be used in a memory of the type described with reference to FIG. 1.

[0012] FIG. 4A is a plan view of transistors of the related art.

[0013] FIG. 4B is a cross-sectional view of transistors of FIG. 4A.

[0014] FIG. 5A is a plan view of transistors in accordance with an embodiment.

[0015] FIG. 5B is a cross-sectional view of transistors of FIG. 5A.

[0016] FIG. 6A is a plan view of a transistor in accordance with an embodiment.

[0017] FIGS. 6B-6E are cross-sectional views of the transistor of FIG. 6A.

[0018] FIGS. 7A-7M are cross-sectional views of the transistors of FIG. 5B at various states of fabrication in accordance with an embodiment.

[0019] FIGS. 8A-8B are cross-sectional views of transistors in accordance with further embodiments.

[0020] FIGS. 9A-9B are perspective views of a semiconductor having fins in accordance with embodiments.

[0021] FIG. 10 is a flowchart of a method of forming a transistor in accordance with an embodiment.

[0022] FIG. 11 conceptually depicts connection of a portion of a string driver connected to access lines of multiple blocks of memory cells in accordance with an embodiment.

DETAILED DESCRIPTION

[0023] In the following detailed description, reference is made to the accompanying drawings that form a part hereof, and in which is shown, by way of illustration, specific embodiments. In the drawings, like reference numerals describe substantially similar components throughout the several views. Other embodiments might be utilized and structural, logical and electrical changes might be made

without departing from the scope of the present disclosure. The following detailed description is, therefore, not to be taken in a limiting sense.

[0024] The term “semiconductor” used herein can refer to, for example, a layer of material, a wafer, or a substrate, and includes any base semiconductor structure. “Semiconductor” is to be understood as including silicon-on-sapphire (SOS) technology, silicon-on-insulator (SOI) technology, thin film transistor (TFT) technology, doped and undoped semiconductors, epitaxial layers of a silicon supported by a base semiconductor structure, as well as other semiconductor structures well known to one skilled in the art. Furthermore, when reference is made to a semiconductor in the following description, previous process steps might have been utilized to form regions/junctions in the base semiconductor structure, and the term semiconductor can include the underlying layers containing such regions/junctions.

[0025] The term “conductive” as used herein, as well as its various related forms, e.g., conduct, conductively, conducting, conduction, conductivity, etc., refers to electrically conductive unless otherwise apparent from the context. Similarly, the term “connecting” as used herein, as well as its various related forms, e.g., connect, connected, connection, etc., refers to electrically connecting unless otherwise apparent from the context.

[0026] It is recognized herein that even where values might be intended to be equal, variabilities and accuracies of industrial processing and operation might lead to differences from their intended values. These variabilities and accuracies will generally be dependent upon the technology utilized in fabrication and operation of the integrated circuit device. As such, if values are intended to be equal, those values are deemed to be equal regardless of their resulting values.

[0027] FIG. 1 is a simplified block diagram of a first apparatus, in the form of a memory (e.g., memory device) 100, in communication with a second apparatus, in the form of a processor 130, as part of a third apparatus, in the form of an electronic system, according to an embodiment. Some examples of electronic systems include personal computers, personal digital assistants (PDAs), digital cameras, digital media players, digital recorders, games, appliances, vehicles, wireless devices, mobile telephones and the like. The processor 130, e.g., a controller external to the memory device 100, might be a memory controller or other external host device.

[0028] Memory device 100 includes an array of memory cells 104 that might be logically arranged in rows and columns. Memory cells of a logical row are typically connected to the same access line (commonly referred to as a word line) while memory cells of a logical column are typically selectively connected to the same data line (commonly referred to as a bit line). A single access line might be associated with more than one logical row of memory cells and a single data line might be associated with more than one logical column. Memory cells (not shown in FIG. 1) of at least a portion of array of memory cells 104 are capable of being programmed to one of at least two target data states.

[0029] A row decode circuitry 108 and a column decode circuitry 110 are provided to decode address signals. Address signals are received and decoded to access the array of memory cells 104. Memory device 100 also includes input/output (I/O) control circuitry 112 to manage input of commands, addresses and data to the memory device 100 as

well as output of data and status information from the memory device 100. An address register 114 is in communication with I/O control circuitry 112 and row decode circuitry 108 and column decode circuitry 110 to latch the address signals prior to decoding. A command register 124 is in communication with I/O control circuitry 112 and control logic 116 to latch incoming commands.

[0030] A controller (e.g., the control logic 116 internal to the memory device 100) controls access to the array of memory cells 104 in response to the commands and may generate status information for the external processor 130, i.e., control logic 116 is configured to perform access operations (e.g., sensing operations [which might include read operations and verify operations], programming operations and/or erase operations) on the array of memory cells 104. The control logic 116 is in communication with row decode circuitry 108 and column decode circuitry 110 to control the row decode circuitry 108 and column decode circuitry 110 in response to the addresses.

[0031] Control logic 116 might also be in communication with a cache register 118. Cache register 118 latches data, either incoming or outgoing, as directed by control logic 116 to temporarily store data while the array of memory cells 104 is busy writing or reading, respectively, other data. During a programming operation (e.g., write operation), data might be passed from the cache register 118 to the data register 120 for transfer to the array of memory cells 104; then new data might be latched in the cache register 118 from the I/O control circuitry 112. During a read operation, data might be passed from the cache register 118 to the I/O control circuitry 112 for output to the external processor 130; then new data might be passed from the data register 120 to the cache register 118. The cache register 118 and/or the data register 120 might form (e.g., might form a portion of) a page buffer of the memory device 100. A page buffer might further include sensing devices (not shown in FIG. 1) to sense a data state of a memory cell of the array of memory cells 104, e.g., by sensing a state of a data line connected to that memory cell. A status register 122 might be in communication with I/O control circuitry 112 and control logic 116 to latch the status information for output to the processor 130.

[0032] Memory device 100 receives control signals at control logic 116 from processor 130 over a control link 132. The control signals might include a chip enable CE#, a command latch enable CLE, an address latch enable ALE, a write enable WE#, a read enable RE#, and a write protect WP#. Additional or alternative control signals (not shown) might be further received over control link 132 depending upon the nature of the memory device 100. Memory device 100 receives command signals (which represent commands), address signals (which represent addresses), and data signals (which represent data) from processor 130 over a multiplexed input/output (I/O) bus 134 and outputs data to processor 130 over I/O bus 134.

[0033] For example, the commands might be received over input/output (I/O) pins [7:0] of I/O bus 134 at I/O control circuitry 112 and might then be written into command register 124. The addresses might be received over input/output (I/O) pins [7:0] of I/O bus 134 at I/O control circuitry 112 and might then be written into address register 114. The data might be received over input/output (I/O) pins [7:0] for an 8-bit device or input/output (I/O) pins [15:0] for a 16-bit device at I/O control circuitry 112 and then might be

written into cache register **118**. The data might be subsequently written into data register **120** for programming the array of memory cells **104**. For another embodiment, cache register **118** might be omitted, and the data might be written directly into data register **120**. Data might also be output over input/output (I/O) pins [7:0] for an 8-bit device or input/output (I/O) pins [15:0] for a 16-bit device. Although reference might be made to I/O pins, they might include any conductive nodes providing for electrical connection to the memory device **100** by an external device (e.g., processor **130**), such as conductive pads or conductive bumps as are commonly used.

[0034] It will be appreciated by those skilled in the art that additional circuitry and signals can be provided, and that the memory device **100** of FIG. **1** has been simplified. It should be recognized that the functionality of the various block components described with reference to FIG. **1** might not necessarily be segregated to distinct components or component portions of an integrated circuit device. For example, a single component or component portion of an integrated circuit device could be adapted to perform the functionality of more than one block component of FIG. **1**. Alternatively, one or more components or component portions of an integrated circuit device could be combined to perform the functionality of a single block component of FIG. **1**.

[0035] Additionally, while specific I/O pins are described in accordance with popular conventions for receipt and output of the various signals, it is noted that other combinations or numbers of I/O pins (or other I/O node structures) might be used in the various embodiments.

[0036] FIG. **2A** is a schematic of a portion of an array of memory cells **200A**, such as a NAND memory array, as could be used in a memory of the type described with reference to FIG. **1**, e.g., as a portion of array of memory cells **104**. Memory array **200A** includes access lines (e.g., word lines) **202₀** to **202_N**, and data lines (e.g., bit lines) **204₀** to **204_M**. The access lines **202** might be connected to global access lines (e.g., global word lines), not shown in FIG. **2A**, in a many-to-one relationship. For some embodiments, memory array **200A** might be formed over a semiconductor that, for example, might be conductively doped to have a conductivity type, such as a p-type conductivity, e.g., to form a p-well, or an n-type conductivity, e.g., to form an n-well.

[0037] Memory array **200A** might be arranged in rows (each corresponding to an access line **202**) and columns (each corresponding to a data line **204**). Each column might include a string of series-connected memory cells (e.g., non-volatile memory cells), such as one of NAND strings **206₀** to **206_M**. Each NAND string **206** might be connected (e.g., selectively connected) to a common source (SRC) **216** and might include memory cells **208₀** to **208_N**. The memory cells **208** might represent non-volatile memory cells for storage of data. The memory cells **208₀** to **208_N** might include memory cells intended for storage of data, and might further include other memory cells not intended for storage of data, e.g., dummy memory cells. Dummy memory cells are typically not accessible to a user of the memory, and are instead typically incorporated into the string of series-connected memory cells for operational advantages that are well understood.

[0038] The memory cells **208** of each NAND string **206** might be connected in series between a select gate **210** (e.g., a field-effect transistor), such as one of the select gates **210₀**

to **210_M** (e.g., that might be source select transistors, commonly referred to as select gate source), and a select gate **212** (e.g., a field-effect transistor), such as one of the select gates **212₀** to **212_M** (e.g., that might be drain select transistors, commonly referred to as select gate drain). Select gates **210₀** to **210_M** might be commonly connected to a select line **214**, such as a source select line (SGS), and select gates **212₀** to **212_M** might be commonly connected to a select line **215**, such as a drain select line (SGD). Although depicted as traditional field-effect transistors, the select gates **210** and **212** might utilize a structure similar to (e.g., the same as) the memory cells **208**. The select gates **210** and **212** might represent a plurality of select gates connected in series, with each select gate in series configured to receive a same or independent control signal.

[0039] A source of each select gate **210** might be connected to common source **216**. The drain of each select gate **210** might be connected to a memory cell **208₀** of the corresponding NAND string **206**. For example, the drain of select gate **210₀** might be connected to memory cell **208₀** of the corresponding NAND string **206₀**. Therefore, each select gate **210** might be configured to selectively connect a corresponding NAND string **206** to common source **216**. A control gate of each select gate **210** might be connected to select line **214**.

[0040] The drain of each select gate **212** might be connected to the data line **204** for the corresponding NAND string **206**. For example, the drain of select gate **212₀** might be connected to the data line **204₀** for the corresponding NAND string **206₀**. The source of each select gate **212** might be connected to a memory cell **208_N** of the corresponding NAND string **206**. For example, the source of select gate **212₀** might be connected to memory cell **208_N** of the corresponding NAND string **206₀**. Therefore, each select gate **212** might be configured to selectively connect a corresponding NAND string **206** to the corresponding data line **204**. A control gate of each select gate **212** might be connected to select line **215**.

[0041] The memory array in FIG. **2A** might be a quasi-two-dimensional memory array and might have a generally planar structure, e.g., where the common source **216**, NAND strings **206** and data lines **204** extend in substantially parallel planes. Alternatively, the memory array in FIG. **2A** might be a three-dimensional memory array, e.g., where NAND strings **206** might extend substantially perpendicular to a plane containing the common source **216** and to a plane containing the data lines **204** that might be substantially parallel to the plane containing the common source **216**.

[0042] Typical construction of memory cells **208** includes a data-storage structure **234** (e.g., a floating gate, charge trap, or other structure configured to store charge) that can determine a data state of the memory cell (e.g., through changes in threshold voltage), and a control gate **236**, as shown in FIG. **2A**. The data-storage structure **234** might include both conductive and dielectric structures while the control gate **236** is generally formed of one or more conductive materials. In some cases, memory cells **208** might further have a defined source/drain (e.g., source) **230** and a defined source/drain (e.g., drain) **232**. Memory cells **208** have their control gates **236** connected to (and in some cases form) an access line **202**.

[0043] A column of the memory cells **208** might be a NAND string **206** or a plurality of NAND strings **206** selectively connected to a given data line **204**. A row of the

memory cells **208** might be memory cells **208** commonly connected to a given access line **202**. A row of memory cells **208** can, but need not, include all memory cells **208** commonly connected to a given access line **202**. Rows of memory cells **208** might often be divided into one or more groups of physical pages of memory cells **208**, and physical pages of memory cells **208** often include every other memory cell **208** commonly connected to a given access line **202**. For example, memory cells **208** commonly connected to access line **202_N** and selectively connected to even data lines **204** (e.g., data lines **204₀**, **204₂**, **204₄**, etc.) might be one physical page of memory cells **208** (e.g., even memory cells) while memory cells **208** commonly connected to access line **202_N** and selectively connected to odd data lines **204** (e.g., data lines **204₁**, **204₃**, **204₅**, etc.) might be another physical page of memory cells **208** (e.g., odd memory cells). Although data lines **204₃**-**204₅** are not explicitly depicted in FIG. 2A, it is apparent from the figure that the data lines **204** of the array of memory cells **200A** might be numbered consecutively from data line **204₀** to data line **204_M**. Other groupings of memory cells **208** commonly connected to a given access line **202** might also define a physical page of memory cells **208**. For certain memory devices, all memory cells commonly connected to a given access line might be deemed a physical page of memory cells. The portion of a physical page of memory cells (which, in some embodiments, could still be the entire row) that is read during a single read operation or programmed during a single programming operation (e.g., an upper or lower page of memory cells) might be deemed a logical page of memory cells. A block of memory cells might include those memory cells that are configured to be erased together, such as all memory cells connected to access lines **202₀**-**202_N** (e.g., all NAND strings **206** sharing common access lines **202**). Unless expressly distinguished, a reference to a page of memory cells herein refers to the memory cells of a logical page of memory cells.

[0044] Although the example of FIG. 2A is discussed in conjunction with NAND flash, the embodiments and concepts described herein are not limited to a particular array architecture or structure, and can include other structures (e.g., SONOS or other data storage structure configured to store charge) and other architectures (e.g., AND arrays, NOR arrays, etc.).

[0045] FIG. 2B is another schematic of a portion of an array of memory cells **200B** as could be used in a memory of the type described with reference to FIG. 1, e.g., as a portion of array of memory cells **104**. Like numbered elements in FIG. 2B correspond to the description as provided with respect to FIG. 2A. FIG. 2B provides additional detail of one example of a three-dimensional NAND memory array structure. The three-dimensional NAND memory array **200B** might incorporate vertical structures which might include semiconductor pillars where a portion of a pillar might act as a channel region of the memory cells of NAND strings **206**. The NAND strings **206** might be each selectively connected to a data line **204₀**-**204_M** by a select transistor **212** (e.g., that might be drain select transistors, commonly referred to as select gate drain) and to a common source **216** by a select transistor **210** (e.g., that might be source select transistors, commonly referred to as select gate source). Multiple NAND strings **206** might be selectively connected to the same data line **204**. Subsets of NAND strings **206** can be connected to their respective data lines

204 by biasing the select lines **215₀**-**215_K** to selectively activate particular select transistors **212** each between a NAND string **206** and a data line **204**. The select transistors **210** can be activated by biasing the select line **214**. Each access line **202** might be connected to multiple rows of memory cells of the memory array **200B**. Rows of memory cells that are commonly connected to each other by a particular access line **202** might collectively be referred to as tiers.

[0046] The three-dimensional NAND memory array **200B** might be formed over peripheral circuitry **226**. The peripheral circuitry **226** might represent a variety of circuitry for accessing the memory array **200B**. The peripheral circuitry **226** might include complementary circuit elements. For example, the peripheral circuitry **226** might include both n-channel and p-channel transistors formed on a same semiconductor substrate, a process commonly referred to as CMOS, or complementary metal-oxide-semiconductors. Although CMOS often no longer utilizes a strict metal-oxide-semiconductor construction due to advancements in integrated circuit fabrication and design, the CMOS designation remains as a matter of convenience.

[0047] FIG. 2C is a further schematic of a portion of an array of memory cells **200C** as could be used in a memory of the type described with reference to FIG. 1, e.g., as a portion of array of memory cells **104**. Like numbered elements in FIG. 2C correspond to the description as provided with respect to FIG. 2A. Array of memory cells **200C** may include strings of series-connected memory cells (e.g., NAND strings) **206**, access (e.g., word) lines **202**, data (e.g., bit) lines **204**, select lines **214** (e.g., source select lines), select lines **215** (e.g., drain select lines) and source **216** as depicted in FIG. 2A. A portion of the array of memory cells **200A** may be a portion of the array of memory cells **200C**, for example. FIG. 2C depicts groupings of NAND strings **206** into blocks of memory cells **250**, e.g., blocks of memory cells **250₀**-**250_L**. Blocks of memory cells **250** may be groupings of memory cells **208** that may be erased together in a single erase operation, sometimes referred to as erase blocks. Each block of memory cells **250** might include those NAND strings **206** commonly associated with a single select line **215**, e.g., select line **215₀**. The source **216** for the block of memory cells **250₀** might be a same source as the source **216** for the block of memory cells **250_L**. For example, each block of memory cells **250₀**-**250_L** might be commonly selectively connected to the source **216**. Access lines **202** and select lines **214** and **215** of one block of memory cells **250** may have no direct connection to access lines **202** and select lines **214** and **215**, respectively, of any other block of memory cells of the blocks of memory cells **250₀**-**250_L**.

[0048] The data lines **204₀**-**204_M** may be connected (e.g., selectively connected) to a buffer portion **240**, which might be a portion of a data buffer of the memory. The buffer portion **240** might correspond to a memory plane (e.g., the set of blocks of memory cells **250₀**-**250_L**). The buffer portion **240** might include sense circuits (not shown in FIG. 2C) for sensing data values indicated on respective data lines **204**.

[0049] While the blocks of memory cells **250** of FIG. 2C depict only one select line **215** per block of memory cells **250**, the blocks of memory cells **250** might include those NAND strings **206** commonly associated with more than one select line **215**. For example, select line **215₀** of block of memory cells **250₀** might correspond to the select line **215₀** of the memory array **200B** of FIG. 2B, and the block of

memory cells of the memory array 200C of FIG. 2C might further include those NAND strings 206 associated with select lines 215₁-215_K of FIG. 2B. In such blocks of memory cells 250 having NAND strings 206 associated with multiple select lines 215, those NAND strings 206 commonly associated with a single select line 215 might be referred to as a sub-block of memory cells. Each such sub-block of memory cells might be selectively connected to the buffer portion 240 responsive to its respective select line 215.

[0050] FIG. 3A is a schematic of a portion of an array of memory cells and string drivers as could be used in a memory device of the type described with reference to FIG. 1 and depicting a many-to-one relationship between local access lines (e.g., local word lines) 202 and global access lines (e.g., global word lines) 302.

[0051] As depicted in FIG. 3A, a plurality of memory blocks 250 may have their local access lines 202 commonly selectively connected to a plurality of global access lines 302. Although FIG. 3A depicts only memory blocks 250₀ and 250_L (Block 0 and Block L), additional memory blocks 250 may have their access lines 202 commonly connected to global access lines 302 in a like manner. Similarly, although FIG. 3A depicts only four access lines 202, memory blocks 250 may include fewer or more access lines 202.

[0052] To facilitate memory access operations to specific memory blocks 250 commonly coupled to a given set of global access lines 302, each memory block 250 may have a corresponding set of block select transistors 354 in a one-to-one relationship with their access lines 202. Control gates of the set of block select transistors 354 for a given memory block 250 may have their control gates commonly coupled to a corresponding block select line 356. For example, for memory block 250₀, access line 202₀₀ may be selectively connected to global access line 302₀ through block select transistor 354₀₀, access line 202₁₀ may be selectively connected to global access line 302₁ through block select transistor 354₁₀, access line 202₂₀ may be selectively connected to global access line 302₂ through block select transistor 354₂₀, and access line 202₃₀ may be selectively connected to global access line 302₃ through block select transistor 354₃₀, while block select transistors 354₀₀-354₃₀ are responsive to a control signal received on block select line 356₀. The block select transistors 354 for a block of memory cells 250 might collectively be referred to as a string driver, or simply driver circuitry.

[0053] FIG. 3B is a schematic of a portion of one example of a string driver as could be used in a memory of the type described with reference to FIG. 1. The portion of the string driver of FIG. 3B depicts one transistor, e.g., block select transistor 354_{YX}, responsive to a control signal node, e.g., block select line 356_X, and connected between a voltage node, e.g., a global access line 302_Y, configured to supply a voltage level, and a load node, e.g., local access line 202_{YX}, configured to receive that voltage level. For example, the block select transistor 354_{YX} might represent the block select transistor 354₁₀ having a control gate connected to the block select line 356₀, and connected between the global access line 302₁ and the local access line 202₁₀ of the block of memory cells 250₀. The block select transistor 354_{YX} might be a high-voltage n-type FET or nFET.

[0054] FIG. 3C is a schematic of a portion of another example of a string driver as could be used in a memory of the type described with reference to FIG. 1. The portion of the string driver of FIG. 3C depicts two transistors, e.g.,

block select transistor 354_{YX} and block select transistor 354_{Y(X+1)}. Block select transistor 354_{YX} is responsive to a control signal node, e.g., block select line 356_X, and connected between a voltage node, e.g., a global access line 302_Y, configured to supply a voltage level, and a load node, e.g., local access line 202_{YX}, configured to receive that voltage level. For example, the block select transistor 354_{YX} might represent the block select transistor 354₁₀ having a control gate connected to the block select line 356₀ and connected between the global access line 302₁ and the local access line 202₁₀ of the block of memory cells 250₀.

[0055] Block select transistor 354_{Y(X+1)} is responsive to a control signal node, e.g., block select line 356_{X+1}, and connected between a voltage node, e.g., the global access line 302_Y, configured to supply a voltage level, and a load node, e.g., local access line 202_{Y(X+1)}, configured to receive that voltage level. For example, the block select transistor 354_{Y(X+1)} might represent the block select transistor 354_{1L} having a control gate connected to the block select line 356_L and connected between the global access line 302₁ and the local access line 202_{1L} of the block of memory cells 250_L. The block select transistors 354_{YX} and 354_{Y(X+1)} might each be high-voltage n-type FETs or nFETs.

[0056] FIG. 4A is a plan view of transistors of the related art. The transistors of FIG. 4A might be represented by a schematic such as depicted in FIG. 3C. In FIG. 4A, the transistors are formed in an active area 460 of a semiconductor. Each transistor might be formed between a first contact 478, e.g., for connection to a voltage node, and a second contact 480, e.g., for connection to a load node. Such transistors might be responsive to a control signal received on a conductor 464, which might be connected to (and might form) a control gate of one or more transistors.

[0057] Each active area 460 might have a width 461. A distance 463 might represent a width of a conductor 464, a distance 465 might represent the distance between an edge (e.g., nearest edge) of a conductor 464 and an end (e.g., nearest end) of the active area 460, a distance 467 might represent a distance between adjacent edges of the conductors 464, and a distance 469 might represent a distance between adjacent ends of active areas 460. An active area 460 might have a length 471 equal to a sum of the distances 463, 465 and 467 between its ends.

[0058] FIG. 4B is a cross-sectional view of transistors of FIG. 4A taken along line 4B-4B'. FIG. 4B depicts two transistors 454, e.g., 454_X and 454_{X+1}, which might correspond to transistors 354_{YX} and 354_{Y(X+1)} of FIG. 3C. The transistors 454 are formed overlying (e.g., on) a semiconductor 462. The semiconductor 462 might contain monocrystalline silicon or other semiconductor material. The semiconductor 462 might have a conductivity type, e.g., a p-type conductivity. Isolation regions 476 might be formed in the semiconductor 462 to define the active areas 460 of FIG. 4A.

[0059] A gate stack of each transistor 454 of FIG. 4B might include a dielectric 466 formed overlying (e.g., on) the semiconductor 462, and a conductor 464 formed overlying (e.g., on) a corresponding gate dielectric 466. The dielectric 466 might generally be formed of one or more dielectric materials, while the conductor 464 might generally be formed of one or more conductive materials. The dielectric 466 might correspond to a gate dielectric of its corresponding transistor 454, while the conductor 464 might correspond to a control gate of that corresponding transistor 454.

[0060] A first extension region 468 might be formed in the semiconductor 462 between the gate stacks of the transistors 454. The first extension region 468 might have a conductivity type different than (e.g., opposite of) the conductivity type of the semiconductor 462. Continuing with the example, the first extension region 468 might have an n-type conductivity. The conductivity level of the first extension region 468 might be referred to as lightly doped, e.g., having an n- conductivity. To produce an n-type conductivity in a p-type substrate, a dopant species might include ions of arsenic (As), antimony (Sb), phosphorus (P) or another n-type impurity. Alternatively, to produce a p-type conductivity in an n-type substrate, a dopant species might include ions of boron (B) or another p-type impurity.

[0061] A first source/drain region (e.g., source) 470 might be formed in the first extension region 468. The first source/drain region 470 might have a conductivity type the same as the conductivity type of the first extension region 468, but at a higher conductivity level. For example, the first source/drain region 470 might have an n+ conductivity. The difference in conductivity levels might correspond to different levels of impurities, e.g., dopant species, implanted in the semiconductor 462. The level of impurities of the first source/drain region 470 might be an order of magnitude or more than the level of impurities of the first extension region 468. As one example, an n- conductivity might represent an impurity level of $1\text{E}16\sim 1\text{E}19\text{ ions/cm}^{-3}$ while an n+ conductivity might represent an impurity level of greater than or equal to $1\text{E}20\text{ ions/cm}^{-3}$.

[0062] A first contact 478 might be formed to be connected to the first source/drain region 470. The first contact 478 might generally be formed of one or more conductive materials. The first contact 478 might be configured to receive a voltage level to provide to the first source/drain region 470. For example, the first contact 478 might be configured to connect to a global access line 302 of FIG. 3A.

[0063] A second extension region 472 might be formed in the semiconductor 462 adjacent each gate stack of the transistors 454. The second extension region 472 might have a conductivity type different than (e.g., opposite of) the conductivity type of the semiconductor 462. Continuing with the example, the second extension region 472 might have an n-type conductivity. The conductivity level of the second extension region 472 might be referred to as lightly doped, e.g., having an n- conductivity.

[0064] A second source/drain region (e.g., drain) 474 might be formed in each second extension region 472. The second source/drain regions 474 might have a conductivity type the same as the conductivity type of the second extension region 472, but at a higher conductivity level. For example, the second source/drain regions 474 might have an n+ conductivity. The difference in conductivity levels might correspond to different levels of impurities, e.g., dopant species, implanted in the semiconductor 462. The level of impurities of the second source/drain regions 474 might be an order of magnitude or more than the level of impurities of the second extension regions 472.

[0065] A second contact 480 might be formed to be connected to each second source/drain region 474. The second contacts 480 might generally be formed of one or more conductive materials. Each second contact 480 might be configured to provide a voltage level at its second

source/drain region 474 to a load. For example, the second contact 480 might be configured to connect to a local access line 202 of FIG. 3A.

[0066] FIG. 5A is a plan view of transistors in accordance with an embodiment. The transistors of FIG. 5A might be represented by a schematic such as depicted in FIG. 3C. In FIG. 5A, the transistors might be formed in an active area 560 of a semiconductor. Each transistor might be formed between a first contact 578, e.g., for connection to a voltage node, and a second contact 580, e.g., for connection to a load node. Such transistors might be responsive to a control signal received on a conductor 564, which might be connected to (and might form) a control gate of one or more transistors.

[0067] Each active area 560 might have a width 561. A distance 563 might represent a width of a conductor 564, a distance 565 might represent the distance between an edge (e.g., nearest edge) of a conductor 564 and an end (e.g., nearest end) of the active area 560, a distance 567 might represent a distance between adjacent edges of the conductors 564, and a distance 569 might represent a distance between adjacent ends of active areas 560. An active area 560 might have a length 571 equal to a sum of each of the distances 563, 565 and 567 between its ends. For some embodiments, the distances 563 and 569 of FIG. 5A might be substantially equal to distances 463 and 469, respectively, of FIG. 4A.

[0068] FIG. 5B is a cross-sectional view of transistors of FIG. 5A taken along line 5B-5B'. FIG. 5B depicts two transistors 554, e.g., 554_X and 554_{X+1} , which might correspond to transistors 354_{YX} and $354_{Y(X+1)}$ of FIG. 3C. The transistors 554 might be formed overlying (e.g., on) a semiconductor 562 overlying (e.g., on) a substrate 586. The semiconductor 562 might contain monocrystalline silicon or other semiconductor material. The semiconductor 562 might have a conductivity type, e.g., a p-type conductivity. Isolation regions 576 might be formed in the semiconductor 562 to define the active areas 560 of FIG. 5A. The substrate 586 might further contain a semiconductor material. For some embodiments where the substrate 586 contains a semiconductor material, the semiconductor 562 and the substrate 586 might each be formed from a single instance of semiconductor material. For such embodiments, the substrate 586 might have a conductivity type same as or different than (e.g., opposite of) the conductivity type of the semiconductor 562. For example, for embodiments where the substrate 586 has a different conductivity type, the substrate 586 might represent a deep n-well, and the semiconductor 562 might represent a p-well contained within the n-well. For some embodiments, the isolation regions 576 might extend into the substrate 586. For other embodiments, the substrate 586 might contain a dielectric material.

[0069] A gate stack of each transistor 554 of FIG. 5B might include a dielectric 566 formed overlying (e.g., on) the semiconductor 562, and a conductor 564 formed overlying (e.g., on) a corresponding dielectric 566. The dielectric 566 might generally be formed of one or more dielectric materials, while the conductor 564 might generally be formed of one or more conductive materials. The dielectric 566 might correspond to a gate dielectric of its corresponding transistor 554, while the conductor 564 might correspond to a control gate of that corresponding transistor 554.

[0070] A first extension region base 568 might be formed in the semiconductor 562 between the gate stacks of the

transistors **554**. The first extension region base **568** might have a conductivity type different than (e.g., opposite of) the conductivity type of the semiconductor **562**. Continuing with the example, the first extension region base **568** might have an n-type conductivity. The conductivity level of the first extension region base **568** might be referred to as lightly doped, e.g., having an n- conductivity. To produce an n-type conductivity in a p-type semiconductor, a dopant species might include ions of arsenic (As), antimony (Sb), phosphorus (P) or another n-type impurity. Alternatively, to produce a p-type conductivity in an n-type semiconductor, a dopant species might include ions of boron (B) or another p-type impurity.

[0071] A first extension region riser **582** might be formed overlying the first extension region base **568**. The first extension region riser **582** might have a conductivity type the same as the conductivity type of the first extension region base **568**, and at a similar (e.g., same) conductivity level. The first extension region riser **582** might have similar (e.g., the same) materials of construction as the first extension region base **568**. For example, if the semiconductor **562** is monocrystalline silicon, the first extension region riser **582** might be a conductively doped monocrystalline silicon. Alternatively, the first extension region riser **582** might be constructed of other semiconductor materials, different than the semiconductor **562**.

[0072] A first source/drain region (e.g., source) **570** might be formed in the first extension region riser **582**. The first source/drain region **570** might have a conductivity type the same as the conductivity type of the first extension region riser **582**, but at a higher conductivity level. For example, the first source/drain region **570** might have an n+ conductivity. The difference in conductivity levels might correspond to different levels of impurities, e.g., dopant species, implanted in the semiconductor material of the first extension region riser **582**. The level of impurities of the first source/drain region **570** might be an order of magnitude or more than the level of impurities of the first extension region riser **582**. As one example, an n- conductivity might represent an impurity level of $1\text{E}16\text{--}1\text{E}19\text{ ions/cm}^{-3}$ while an n+ conductivity might represent an impurity level of greater than or equal to $1\text{E}20\text{ ions/cm}^{-3}$.

[0073] A first contact **578** might be formed to be connected to the first source/drain region **570**. The first contact **578** might generally be formed of one or more conductive materials. The first contact **578** might be configured to receive a voltage level to provide to the first source/drain region **570**. For example, the first contact **578** might be configured to connect to a global access line **302** of FIG. 3A.

[0074] A second extension region base **572** might be formed in the semiconductor **562** adjacent each gate stack of the transistors **554**. The second extension region base **572** might have a conductivity type different than (e.g., opposite of) the conductivity type of the semiconductor **562**. Continuing with the example, the second extension region base **572** might have an n-type conductivity. The conductivity level of the second extension region base **572** might be referred to as lightly doped, e.g., having an n- conductivity.

[0075] A second extension region riser **584** might be formed overlying the second extension region base **572**. The second extension region riser **584** might have a conductivity type the same as the conductivity type of the second extension region base **572**, and at a similar (e.g., same) conductivity level. The second extension region riser **584** might

have similar (e.g., the same) materials of construction as the second extension region base **572**. For example, if the semiconductor **562** is monocrystalline silicon, the second extension region riser **584** might be a conductively doped monocrystalline silicon. Alternatively, the second extension region riser **584** might be constructed of other semiconductor materials, different than the semiconductor **562**.

[0076] A second source/drain region (e.g., drain) **574** might be formed in each second extension region riser **584**. The second source/drain regions **574** might have a conductivity type the same as the conductivity type of the second extension region riser **584**, but at a higher conductivity level. For example, the second source/drain regions **574** might have an n+ conductivity. The difference in conductivity levels might correspond to different levels of impurities, e.g., dopant species, implanted in the semiconductor **562**. The level of impurities of the second source/drain regions **574** might be an order of magnitude or more than the level of impurities of the second extension region riser **584**.

[0077] A second contact **580** might be formed to be connected to each second source/drain region **574**. The second contacts **580** might generally be formed of one or more conductive materials. Each second contact **580** might be configured to provide a voltage level at its second source/drain region **574** to a load. For example, the second contact **580** might be configured to connect to a local access line **202** of FIG. 3A.

[0078] The use of the first extension region riser **582** and/or the second extension region riser **584** might facilitate a reduction in lateral spacing between the first contact **578** and an isolation region **576** over the structure of FIG. 4B, e.g., in the direction of the length of the transistors. For example, use of the first extension region riser **582** of FIG. 5B might facilitate a reduction in lateral spacing between the first contact **578** and the conductor **564** of a transistor **554**. The use of the first extension region riser **582** might further provide a same or increased length of the extension region between the first source/drain region **570** and the channel of a transistor **554** as compared to the extension region between the first source/drain region **470** and the channel of a transistor **454** of FIG. 4B. Similarly, use of the second extension region riser **584** of FIG. 5B might facilitate a reduction in lateral spacing between the second contact **580** and the conductor **564** of a transistor **554**. The use of the second extension region riser **584** might further provide a same or increased length of the extension region between the second source/drain region **574** and the channel of a transistor **554** as compared to the extension region between the second source/drain region **474** and the channel of a transistor **454** of FIG. 4B. Furthermore, use of the second extension region riser **584** of FIG. 5B might facilitate a reduction in lateral spacing between the second contact **580** and an adjacent isolation region **576** as there might be no need to laterally separate the second source/drain region **574** from the adjacent isolation region **576** in a manner as depicted between the second source/drain region **474** and an adjacent isolation region **476**.

[0079] Various embodiments might further incorporate fins in the channel of the transistors **554**. Such embodiments might facilitate a reduction in the width **561** of an active area **560** of FIG. 5A relative to the width **461** of an active area **460** of FIG. 4A, e.g., in the direction of the width of the transistors. FIG. 6A is a plan view of a transistor **554A** in accordance with an embodiment. FIG. 6B is a cross-section

tional view of the transistor **554A** taken along line **6B-6B'** of FIG. **6A**, FIG. **6C** is a cross-sectional view of the transistor **554A** taken along line **6C-6C'** of FIG. **6A**, FIG. **6D** is a cross-sectional view of the transistor **554A** taken along line **6D-6D'** of FIG. **6A**, and FIG. **6E** is a cross-sectional view of the transistor **554A** taken along line **6E-6E'** of FIG. **6A**. Like numbered elements of FIGS. **6A-6E** correspond to the description as provided with respect to FIGS. **5A-5B**.

[0080] FIG. **6A** depicts the first contact **578** and the second contact **580** overlying an active area **560** including the semiconductor **562**. The conductor **564** might be overlying the semiconductor **562** and dielectric plugs **588**. The dielectric plugs **588** might be formed between portions of the semiconductor **562** to define fins between the dielectric plugs **588**. For clarity, dielectric material formed outside the boundaries of the active area **560** is not depicted in FIG. **6A**.

[0081] FIG. **6B** depicts portions of the semiconductor **562** defining fins between instances of the dielectric plugs **588**. For some embodiments, the fins of the semiconductor **562** might have an aspect ratio (e.g., height over width) in the range of 2 to 4. For some embodiments, the fins of the semiconductor **562** might have a height of 500 nm±300 nm. The dielectric plugs **588** might have a height less than the height of the fins of the semiconductor **562**. For some embodiments, the dielectric plugs **588** might have a height of 100 nm±30 nm. The dielectric plugs **588** might have a height sufficient to mitigate formation of parasitic transistors between the conductor and the substrate **586**. For some embodiments, the height of the fins of the semiconductor **562** might be in a range of 5 to 15 times the height of the dielectric plugs **588**.

[0082] A dielectric (e.g., gate dielectric) **566** might be formed overlying (e.g., on) portions of the fins of the semiconductor **562**, e.g., overlying an upper surface and portions of sidewalls of a fin of the semiconductor **562**. For example, the dielectric **566** might be formed on portions of the fins of the semiconductor **562** extending beyond (e.g., above) the dielectric plugs **588**. The conductor (e.g., control gate) **564** might be formed to extend between and overlying the fins of the semiconductor **562**. The conductor **564** might extend to a surface (e.g., upper surface) of the dielectric plugs **588**. With the dielectric **566** formed to be overlying an upper surface and sidewalls of a fin of the semiconductor **562**, the effective operational width of the transistor **554A** might be increased while decreasing a physical width of the transistor **554A**, e.g., decreasing the width **561** of an active area **560**. Although the example of FIG. **6B** depicts four fins of the semiconductor **562**, more or fewer fins could be used.

[0083] FIG. **6C** depicts a dielectric **566** optionally overlying a first extension region base **568** in a portion of the semiconductor **562**. Instances of dielectric plugs **588** might be formed adjacent sidewalls of the semiconductor **562** overlying the substrate **586**. FIG. **6C** depicts that the fins of the semiconductor **562** might not extend a full width of an active area, e.g., the portion of the semiconductor **562** depicted in FIG. **6C** might bridge gaps between the fins of the semiconductor **562** depicted in FIG. **6B**.

[0084] FIG. **6D** depicts a dielectric **566** optionally overlying an upper surface and sides walls of a first extension region base **568** and a second extension region base **572**, as well as sidewalls of portions of the semiconductor **562**. An instance of a dielectric plug **588** might be formed between the portions of the semiconductor **562** and overlying the substrate **586**. A conductor **564** might be formed overlying

the dielectric plug **588**. A first extension region riser **582** might be formed overlying the first extension region base **568**, and a first source/drain region **570** might be formed in the first extension region riser **582**. A second extension region riser **584** might be formed overlying the second extension region base **572**, and a second source/drain region **574** might be formed in the second extension region riser **584**. In the embodiment depicted in FIG. **6D**, the fins of the semiconductor do not extend a full length of the active area. However, other embodiments might pattern the semiconductor **562** to define fins extending the full length of the active area.

[0085] FIG. **6E** depicts a dielectric **566** overlying a semiconductor **562** and optionally overlying an upper surface of a first extension region base **568** and a second extension region base **572**. A conductor **564** might be formed overlying the gate dielectric **566**. A first extension region riser **582** might be formed overlying the first extension region base **568**, and a first source/drain region **570** might be formed in the first extension region riser **582**. A second extension region riser **584** might be formed overlying the second extension region base **572**, and a second source/drain region **574** might be formed in the second extension region riser **584**. A first contact **578** might be formed to be connected to the first source/drain region **570**. A second contact **580** might be formed to be connected to the second source/drain region **574**. FIG. **6E** further depicts that the distance (e.g., lateral distance) **696** between the first extension region riser **582** and the conductor **564** might be different than the distance (e.g., lateral distance) **698** between the second extension region riser **584** and the conductor **564**. For example, if it is desired to have different lengths of the extension regions between the source side and the drain side of the transistor **554A**, e.g., due to an expected voltage drop across the transistor **554A**, having different distances **696** and **698** might facilitate obtaining differing lengths of extension regions while maintaining a same height of the extension region risers **582** and **584**. For example, the distance **696** might be larger than the distance **698**. This variation of distances **696** and **698** might also be utilized in transistor configurations in accordance with other embodiments, e.g., such as depicted in FIG. **5B**.

[0086] FIGS. **7A-7M** are cross-sectional views of the transistors of FIG. **5B** at various states of fabrication in accordance with an embodiment. Like numbered elements in FIGS. **7A-7M** correspond to the description as provided with respect to FIGS. **5A-5B**.

[0087] In FIG. **7A**, a semiconductor **562** might be formed overlying, e.g., on, a substrate **586**. The semiconductor **562** may comprise silicon, such as monocrystalline silicon, or other semiconductor material. The semiconductor **562** might have a conductivity type, such as a p-type conductivity. The substrate **586** might further contain a semiconductor material. For other embodiments, the substrate **586** might contain a dielectric material. For some embodiments where the substrate **586** contains a semiconductor material, the semiconductor **562** and the substrate **586** might represent two portions of a single instance of semiconductor material. For some embodiments, the isolation regions **576** might extend into the substrate **586**.

[0088] In FIGS. **7B** and **7C**, the semiconductor **562** might be patterned to define a width **561** of an active area and to define fins of the semiconductor **562**. FIG. **7B** might depict the view of FIG. **7A** following patterning of the semicon-

ductor **562**, while FIG. 7C might depict the cross-sectional view of FIG. 7B taken along line 7C-7C'. Patterning might include removal of portions of the semiconductor **562** using photolithographic techniques or other processes for the selective removal of a material. The fins of the semiconductor **562** might extend orthogonal to the width **561** of an active area. For some embodiments, the cross-section of FIG. 7C might extend less than the length **571** of the active area of FIG. 7B. For example, formation of the fins of the semiconductor **562** might form closed trenches, e.g., container-shaped cavities, between the fins of the semiconductor **562**. For other embodiments, the cross-section of FIG. 7C might extend the full length **571** of the active area of FIG. 7B. For example, formation of the fins of the semiconductor **562** might form open trenches between the fins of the semiconductor **562**, e.g., with no portion of the semiconductor **562** bridging a gap between two fins of the semiconductor **562**.

[0089] In FIGS. 7D and 7E, plugs **588** of a dielectric material might be formed overlying (e.g., on) exposed portions of the substrate **586**. FIG. 7D corresponds to the structure depicted in FIG. 7B and FIG. 7E corresponds to the structure depicted in FIG. 7C. The dielectric plugs **588** might contain one or more dielectric materials. For example, the dielectric plugs **588** may comprise, consist of, or consist essentially of an oxide, e.g., silicon dioxide, and/or may comprise, consist of, or consist essentially of a high-K dielectric material, such as aluminum oxides (AlO_x), hafnium oxides (HfO_x), hafnium aluminum oxides (HfAlO_x), hafnium silicon oxides (HfSiO_x), lanthanum oxides (LaO_x), tantalum oxides (TaO_x), zirconium oxides (ZrO_x), zirconium aluminum oxides (ZrAlO_x), or yttrium oxide (Y_2O_3), as well as any other dielectric material. The dielectric plugs **588** might be formed by blanket depositing a dielectric material followed by an etch-back to obtain a desired height of the dielectric plugs **588**.

[0090] In FIG. 7F, portions of isolation regions **576** might be formed adjacent the semiconductor **562**. Isolation regions **576** might represent shallow-trench isolation structures as are well understood in the relevant art. For example, the isolation regions **576** might be formed by filling trenches (not shown) adjacent the active area with one or more dielectric materials.

[0091] In FIG. 7G, a dielectric **566** might be formed overlying (e.g., on) the structure of FIG. 7F, e.g., overlying the semiconductor **562** and isolation regions **576**. The dielectric **566** might be formed of one or more dielectric materials. For example, the dielectric **566** may comprise, consist of, or consist essentially of an oxide, e.g., silicon dioxide, and/or may comprise, consist of, or consist essentially of a high-K dielectric material, such as aluminum oxides (AlO_x), hafnium oxides (HfO_x), hafnium aluminum oxides (HfAlO_x), hafnium silicon oxides (HfSiO_x), lanthanum oxides (LaO_x), tantalum oxides (TaO_x), zirconium oxides (ZrO_x), zirconium aluminum oxides (ZrAlO_x), or yttrium oxide (Y_2O_3), as well as any other dielectric material. The dielectric **566** might contain a same, or different, dielectric material or materials as the dielectric plugs **588**.

[0092] A conductor **564** might be formed overlying (e.g., on) the dielectric **566**. The conductor **564** might be formed of one or more conductive materials. The conductor **564** may comprise, consist of, or consist essentially of conductively doped polysilicon and/or may comprise, consist of, or consist essentially of metal, such as a refractory metal, or a

metal-containing material, such as a refractory metal silicide or a metal nitride, e.g., a refractory metal nitride, as well as any other conductive material.

[0093] A patterned mask **790** might be formed overlying (e.g., on) the conductor **564** to expose areas of the conductor **564** and dielectric **566** for removal. The mask **790** might represent a mask formed using a photolithographic process. Photolithographic processes are often used to define a desired pattern in integrated circuit fabrication. In a photolithographic process, a photoresist layer may be formed on the surface of the in-process device. The photoresist layer may contain a photo-sensitive polymer whose case of removal is altered upon exposure to light or other electromagnetic radiation. To define the pattern, the photoresist layer may be selectively exposed to radiation and then developed to expose portions of the underlying layer. In a positive resist system, the portions of the photoresist layer exposed to the radiation are photosolubilized and a photolithographic mask is designed to block the radiation from those portions of the photoresist layer that are to remain after developing. In a negative resist systems, the portions of the photoresist layer exposed to the radiation are photopolymerized and the photolithographic mask is designed to block the radiation from those portions of the photoresist layer that are to be removed by developing.

[0094] In FIG. 7H, the exposed areas of the conductor **564** and the dielectric **566** might be removed, e.g., anisotropically. For example, a reactive ion etch process might be used to remove portions of the conductor **564** and the dielectric **566** not covered by the patterned mask **790**. The mask **790** might subsequently be removed, e.g., by ashing or otherwise removing the photoresist material. Remaining portions of the conductor **564** might represent control gates of the future transistors.

[0095] In FIG. 7I, the first extension region base **568** and the second extension region bases **572** might be formed. The first extension region base **568** might extend beyond one edge of each conductor **564**, while each second extension region base **572** might extend beyond an opposite edge of its corresponding conductor **564**. The second extension region bases **572** might further extend to corresponding isolation regions **576**. Forming these extension region bases **568** and **572** might include conductively doping portions of the semiconductor **562** not covered by the conductor **564**. For example, the first extension region base **568** and the second extension region bases **572** might be formed by implanting respective dopant species into the semiconductor **562**. As is well understood in the art, such implantation might commonly involve acceleration of ions directed at a surface of the semiconductor **562**. To produce an n-type conductivity, the dopant species might include ions of arsenic (As), antimony (Sb), phosphorus (P) or another n-type impurity. To produce a p-type conductivity, the dopant species might include ions of boron (B) or another p-type impurity. Other methods of forming conductive regions in a semiconductor are known. Although implanting dopant species might be self-aligned to the gate stacks, it might further be expected for the extension region bases **568** and **572** to extend beneath the conductors **564**. A channel region would be the area underlying the dielectric **566** between the first extension region base **568** and a corresponding second extension region base **572**. For some embodiments, the fins of the semiconductor **562** might extend a full length of the channel

region. For further embodiments, the fins of the semiconductor 562 might extend beyond the full length of the channel region.

[0096] In FIG. 7J, a dielectric 792 might be formed overlying the structure of FIG. 7I. The dielectric 792 might contain one or more dielectric materials. In FIG. 7K, voids 794 might be formed in the dielectric 792 to define areas for formation of the extension region risers. For example, portions of the dielectric 792 might be anisotropically removed to define voids 794. In FIG. 7L, the first extension region riser 582 and the second extension region risers 584 might be formed, e.g., concurrently. Top surfaces of the first extension region riser 582 and the second extension region risers 584 might be above top surfaces of the conductors 564. The first extension region riser 582 and the second extension region risers 584 might be formed of material having characteristics similar to their corresponding first extension region base 568 and second extension region bases 572. As one example, where the semiconductor 562 contains monocrystalline silicon, amorphous or polycrystalline silicon (commonly referred to as polysilicon) might be formed in the voids 794 using chemical vapor deposition (CVD), physical vapor deposition (PVD) or atomic layer deposition (ALD), and subsequently crystallized to mimic the characteristics of the underlying extension region bases. This might be accomplished by solid phase epitaxy. For example, solid phase epitaxy might include a low temperature (e.g., 700° C. for 30 minutes) anneal.

[0097] Alternatively, a selective epitaxial growth of monocrystalline silicon might be used to form the risers. Epitaxial formation of silicon is a CVD process. The process can replicate the structure of the silicon material upon which it is formed. For example, if the base structure is of monocrystalline silicon, the epitaxial growth might maintain the same monocrystalline structure. Silicon precursors are transported to, and adsorbed on, the exposed silicon structures. Common silicon precursors for the production of epitaxial silicon include silicon tetrachloride (SiCl_4), trichlorosilane (SiHCl_3), dichlorosilane (SiH_2Cl_2) and silane (SiH_4). As a further alternative, epitaxial growth of high band-gap semiconductors might also be used. High band-gap semiconductors might be defined as semiconductors having a band gap of 1.7 eV or greater. Some high band-gap semiconductors, e.g., gallium phosphide (GaP), might be epitaxially grown on silicon to contain a single crystal lattice of that high band-gap semiconductor.

[0098] Regardless of the method of formation, conductive doping of the first extension region riser 582 and the second extension region risers 584 might be performed in conjunction with formation, or subsequent to formation. Conductive doping of the extension region risers 582 and 584 might use a same type (e.g., n-type or p-type) of doping impurity as the extension region bases 568 and 572, but to a higher level. The doping impurity might further be the same material for both the extension region risers and the extension region bases.

[0099] In FIG. 7M, the first source/drain region 570 and the second source/drain regions 574 might be formed in the first extension region riser 582 and the second extension region risers 584, respectively. Bottom surfaces of the first source/drain region 570 and the second source/drain regions 574 might be above top surfaces of the conductors 564. Formation of the source/drain regions 570 and 574 might include conductively doping the extension region risers 582

and 584 using a same type (e.g., n-type or p-type) of doping impurity as the extension region risers, but to a higher level. The doping impurity might further be the same material for both the extension region risers 582 and 584, and the source/drain regions 570 and 574. Contacts 578 and 580 (not shown in FIG. 7M) might then be formed to be in contact with the source/drain regions 570 and 574, respectively. Although FIGS. 7A-7M described a method of forming the transistors 554 of FIG. 5B corresponding to a schematic as depicted in FIG. 3C, forming a transistor 554 corresponding to a schematic of FIG. 3B would be readily apparent with reference to the description of FIGS. 7A-7M.

[0100] Although not depicted in FIGS. 7A-7M, a first set of fins of the semiconductor 562 might be formed to extend from the first extension region base 568 to one of the second extension region bases 572, and a second set of fins of the semiconductor 562 might be formed to extend from the first extension region base 568 to the other one of the second extension region bases 572. Each set of fins of the semiconductor 562 might not extend through the first extension region base 568 to make contact with one another, e.g., similar to the example of FIG. 6D. Formation of such fins of the semiconductor 562 might form closed trenches in the semiconductor 562. Alternatively, the example of FIGS. 7A-7M might include a single set of fins of the semiconductor 562 for both transistors depicted. Formation of such fins of the semiconductor 562 might form open trenches in the semiconductor 562.

[0101] FIGS. 8A-8B are cross-sectional views of transistors 554 in accordance with further embodiments. Like numbered elements in FIGS. 8A-8B correspond to the description as provided with respect to FIGS. 5A-5B.

[0102] The embodiment of FIG. 8A, like the embodiments of FIGS. 5B and 7M, might correspond schematically to the circuit of FIG. 3C. However, instead of having a shared first extension region base 568, a shared first extension region riser 582, and a shared first contact 578, the embodiment of FIG. 8A might utilize a shared first extension region base 568, but two first extension region risers 582, two first source/drain regions 570, and two first contacts 578, e.g., one set for each transistor 554. The first contacts 578 might be electrically connected, e.g., shorted, to one another using a conductor 899 connected to each first contact 578 of the transistors 554_x and 554_{x+1}. The conductor 899 might be formed of one or more conductive materials, and might be connected to the voltage node, e.g., a global access line 302.

[0103] The embodiment of FIG. 8B, like the embodiments of FIGS. 5B and 7M, might correspond schematically to the circuit of FIG. 3C. However, instead of having a shared first extension region base 568, a shared first extension region riser 582, and a shared first contact 578, the embodiment of FIG. 8B might utilize two first extension region bases 568, two first extension region risers 582, two first source/drain regions 570, and two first contacts 578, e.g., one set for each transistor 554. The first contacts 578 might be electrically connected, e.g., shorted, to one another using a conductor 899 connected to each first contact 578 of the transistors 554_x and 554_{x+1}. The conductor 899 might be formed of one or more conductive materials, and might be connected to the voltage node, e.g., a global access line 302. The two first extension region bases 568 might be separated by an isolation region 576, e.g., they might be electrically isolated from one another but for their connection through their corresponding first extension region risers 582, their correspond-

ing first source/drain regions **570**, their corresponding first contacts **578**, and the conductor **899**.

[0104] FIG. 9A depicts an example of closed trenches **901** formed in the semiconductor **562** to define fins **905**. The closed trenches **901** might extend to a surface (e.g., upper surface) of the substrate **586**. A portion **907** of the semiconductor **562** might bridge a gap defined by a closed trench **901** between two of the fins **905** in the semiconductor **562**. Although not enumerated in the drawing, the semiconductor **562** might include portions bridging the gap between each pair of fins **905** of the semiconductor **562** at both ends of each closed trench **901**. The structure depicted in FIG. 9A might define an active area **560** for the formation of two transistors, e.g., transistor 554_X and 554_{X+1} of FIG. 5B. Alternatively, the structure depicted in FIG. 9A might define a contiguous portion of an active area **560** extending for a distance **565**, plus a distance **563**, plus one-half the distance **567**, for the formation of one transistor, e.g., transistor 554_X or 554_{X+1} of FIG. 5B. For such an embodiment, the active area **560** might include the structure depicted in FIG. 9A and its mirror image, with the fins **901** of each structure extending in the direction of the length **571** of the active area **560**.

[0105] FIG. 9B depicts an example of open trenches **903** formed in the semiconductor **562** to define fins **905**. The open trenches **903** might extend to a surface (e.g., upper surface) of the substrate **586**. The structure depicted in FIG. 9B might define an active area **560** for the formation of two transistors, e.g., transistor 554_X and 554_{X+1} of FIG. 5B.

[0106] FIG. 10 is a flowchart of a method of forming a transistor in accordance with an embodiment. At **1011** a semiconductor might be formed and patterned to define fins. For example, a semiconductor **562** might be formed and patterned to define fins **901** or **903**. The semiconductor might have a first conductivity type. At **1013**, plugs of a first dielectric might be formed between the fins of the semiconductor. For example, dielectric plugs **588** might be formed.

[0107] At **1011**, a second dielectric might be formed overlying the semiconductor. For example, a dielectric **566** might be formed. At **1017**, a conductor might be formed overlying the second dielectric. For example, a conductor **564** might be formed. At **1019**, the conductor might be patterned to define a gate stack of the transistor. For some embodiments, the second dielectric might be concurrently patterned with the conductor.

[0108] At **1021**, a first extension region base and a second extension region base might be formed in the semiconductor. For example, a first extension region base **568** and a second extension region base **572** might be formed. The first extension region base and the second extension region base might have a second conductivity type, different than the first conductivity type. The first extension region base and the second extension region base might further have a first conductivity level.

[0109] At **1023**, a first extension region riser and a second extension region riser might be formed. For example, a first extension region riser **582** and a second extension region riser **584** might be formed. The first extension region riser might be formed overlying the first extension region base, and the second extension region riser might be formed overlying the second extension region base. The first extension region riser and the second extension region riser might have the second conductivity type. The first extension region riser and the second extension region riser might further have the first conductivity level.

[0110] At **1025**, a first source/drain region and a second source/drain region might be formed. For example, a first source/drain region **570** and a second source/drain region **574** might be formed. The first source/drain region might be formed in the first extension region riser, and the second source/drain region might be formed in the second extension region riser. The first source/drain region and the second source/drain region might have the second conductivity type. The first source/drain region and the second source/drain region might further have conductivity level greater than the first conductivity level.

[0111] FIG. 11 conceptually depicts connection of a portion of a string driver circuitry connected to access lines of multiple blocks of memory cells in accordance with an embodiment. For example, a first string driver 1130_0 might have transistors (not enumerated in FIG. 11) corresponding to conductor 564_0 and connected between first contacts **578**, e.g., first contacts 578_X , 578_{X+1} , and 578_{X+2} , and corresponding second contacts **580**, e.g., second contacts 580_{X0} , $580_{(X+1)0}$, and $580_{(X+2)0}$, respectively, and a second string driver 1130_1 might have transistors (not enumerated in FIG. 11) corresponding to conductor 564_1 and connected between first contacts **578**, e.g., first contacts 578_X , 578_{X+1} , and 578_{X+2} , and corresponding second contacts **580**, e.g., second contacts 580_{X1} , $580_{(X+1)1}$, and $580_{(X+2)1}$, respectively. The transistors of the string drivers 1130_0 and 1130_1 might correspond to transistors **554** depicted in FIGS. 5A and 5B, for example.

[0112] The second contacts 580_{X0} , $580_{(X+1)0}$, and $580_{(X+2)0}$ of the first string driver 1130_0 might be connected to access lines 202_{X0} , $202_{(X+1)0}$, and $202_{(X+2)0}$, respectively, of a block of memory cells 250_0 . The access lines 202_{X0} , $202_{(X+1)0}$, and $202_{(X+2)0}$ might represent only a portion of access lines of the block of memory cells 250_0 . For example, the block of memory cells 250_0 might include N+1 access lines **202** such as depicted in FIG. 2A, and the access lines 202_{X0} , $202_{(X+1)0}$, and $202_{(X+2)0}$ of the block of memory cells 250_0 might correspond to access lines 202_X , 202_{X+1} , and 202_{X+2} , respectively, of FIG. 2A.

[0113] The second contacts 580_{X1} , $580_{(X+1)1}$, and $580_{(X+2)1}$ of the second string driver 1130_1 might be connected to access lines 202_{X1} , $202_{(X+1)1}$, and $202_{(X+2)1}$, respectively, of a block of memory cells 250_1 . The access lines 202_{X1} , $202_{(X+1)1}$, and $202_{(X+2)1}$ might represent only a portion of access lines of the block of memory cells 250_1 . For example, the block of memory cells 250_1 might include N+1 access lines **202** such as depicted in FIG. 2A, and the access lines 202_{X1} , $202_{(X+1)1}$, and $202_{(X+2)1}$ of the block of memory cells 250_1 might correspond to access lines 202_X , 202_{X+1} , and 202_{X+2} , respectively, of FIG. 2A.

[0114] The string drivers 1130_0 and 1130_1 might be a portion of the peripheral circuitry **226** of FIG. 2C. For example, the string driver 1130_0 might be formed under (e.g., at least partially under) the access lines 202_{X0} , $202_{(X+1)0}$, and $202_{(X+2)0}$ of the block of memory cells 250_0 . Similarly, the string driver 1130_1 might be formed under (e.g., at least partially under) the access lines 202_{X1} , $202_{(X+1)1}$, and $202_{(X+2)1}$ of the block of memory cells 250_1 .

[0115] The blocks of memory cells 250_0 and 250_1 might include more than one sub-block of memory cells. For example, the blocks of memory cells 250_0 and 250_1 might have an architecture corresponding to the array of memory cells **200B** of FIG. 2B, where the array of memory cells **200B** would have K+1 sub-blocks, with each sub-block

including those memory cells selectively connected to a corresponding data line **204** in response to one select line **215** of the select lines **215₀-215_K**. A pitch between such sub-blocks of memory cells might extend in the direction of the data lines **204**. Pitch refers to a distance between repeated elements in a structure possessing translational symmetry. For example, a pitch of the sub-blocks might represent a distance between one edge of a NAND string of memory cells **206** of the sub-block of memory cells corresponding to the select line **215₀**, and a corresponding edge of an adjacent NAND string of memory cells **206** of the sub-block of memory cells corresponding to the select line **215₁**.

[0116] Similarly, the string drivers **1130₀** and **1130₁** might have a pitch in the same linear direction as the sub-blocks of memory cells. With reference to FIG. 5A, this pitch of the string drivers **1130₀** and **1130₁** might correspond to one-half the distance **567**, plus the distance **563**, plus the distance **565**, plus one-half the distance **569**. For some embodiments, the pitch of the string drivers **1130₀** and **1130₁** might be less than three times the pitch of the sub-blocks of memory cells of the blocks of memory cells **250₀** and **250₁**, respectively. For further embodiments, the pitch of the string drivers **1130₀** and **1130₁** might be less than 2.5 times the pitch of the sub-blocks of memory cells of the blocks of memory cells **250₀** and **250₁**, respectively.

CONCLUSION

[0117] Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that any arrangement that is calculated to achieve the same purpose may be substituted for the specific embodiments shown. Many adaptations of the embodiments will be apparent to those of ordinary skill in the art. Accordingly, this application is intended to cover any adaptations or variations of the embodiments.

What is claimed is:

1. An apparatus, comprising:
 - a voltage node;
 - a load node; and
 - a transistor connected between the voltage node and the load node, the transistor comprising:
 - a semiconductor overlying a substrate, wherein the semiconductor comprises a plurality of fins overlying the substrate, and wherein the semiconductor has a first conductivity type;
 - a plurality of plugs of a first dielectric, wherein each plug of the plurality of plugs of the first dielectric is formed between a pair of fins of the plurality of fins of the semiconductor;
 - a second dielectric overlying the semiconductor;
 - a conductor overlying the second dielectric;
 - a first extension region base formed in the semiconductor and extending beyond a first edge of the conductor, wherein the first extension region base has a second conductivity type different than the first conductivity type;
 - a second extension region base formed in the semiconductor and extending beyond a second edge of the conductor opposite the first edge of the conductor, wherein the second extension region base has the second conductivity type;

- a first extension region riser formed overlying the first extension region base and having the second conductivity type;
 - a second extension region riser formed overlying the second extension region base and having the second conductivity type;
 - a first source/drain region formed in the first extension region riser and connected to the voltage node, wherein the first source/drain region has the second conductivity type and has a conductivity level greater than a conductivity level of the first extension region riser; and
 - a second source/drain region formed in the second extension region riser and connected to the load node, wherein the second source/drain region has the second conductivity type and has a conductivity level greater than a conductivity level of the second extension region riser.
2. The apparatus of claim 1, wherein the fins of the plurality of fins each have an aspect ratio in a range of 2 to 4.
 3. The apparatus of claim 1, wherein a height of a fin of the plurality of fins is in a range of 5 to 15 times a height of a plug of the plurality of plugs of the first dielectric.
 4. The apparatus of claim 1, wherein the second dielectric comprises a plurality of instances of the second dielectric, and wherein each instance of the second dielectric is formed on an upper surface and on sidewalls of a respective fin of the plurality of fins of the semiconductor material.
 5. The apparatus of claim 1, wherein a portion of the semiconductor bridges a gap between a pair of fins of the plurality of fins of the semiconductor at one end of the pair of fins of the plurality of fins of the semiconductor.
 6. The apparatus of claim 5, wherein the portion of the semiconductor is a first portion of the semiconductor, and wherein a second portion of the semiconductor bridges the gap between the pair of fins of the plurality of fins of the semiconductor at a different end of the pair of fins of the plurality of fins of the semiconductor opposite the one end of the pair of fins of the plurality of fins of the semiconductor.
 7. The apparatus of claim 1, wherein the semiconductor defines an active area of the transistor, wherein the active area of the transistor has a length extending in a direction from an edge of the second extension region base to an opposing edge of the second extension region base, and wherein each fin of the plurality of fins extends for a distance less than the length of the active area of the transistor.
 8. The apparatus of claim 1, wherein the semiconductor comprises a first semiconductor material, wherein the first extension region base comprises the first semiconductor material and a dopant species, and wherein the first extension region riser comprises a second semiconductor material and the dopant species.
 9. The apparatus of claim 8, wherein the second semiconductor material is different than the first semiconductor material.
 10. The apparatus of claim 1, wherein a top surface of the first extension region riser and a top surface of the second extension region riser are above a top surface of the conductor.
 11. The apparatus of claim 1, wherein the transistor is a first transistor, the load node is a first load node, the

conductor is a first conductor, and the second dielectric is a first instance of the second dielectric, and wherein the apparatus further comprises:

- a second load node; and
- a second transistor connected between the voltage node and the second load node, the second transistor comprising:
 - a second instance of the second dielectric overlying the semiconductor;
 - a second conductor overlying the second instance of the second dielectric;
 - a third extension region base formed in the semiconductor and extending beyond a first edge of the second conductor, wherein the third extension region base has the second conductivity type;
 - a third extension region riser formed overlying the third extension region base and having the second conductivity type; and
 - a third source/drain region formed in the third extension region riser and connected to the second load node, wherein the third source/drain region has the second conductivity type and has a conductivity level greater than a conductivity level of the third extension region riser;

wherein the first extension region base extends between the first edge of the first conductor and a second edge of the second conductor opposite the first edge of the second conductor.

12. The apparatus of claim 11, further comprising:

- a fourth extension region riser formed overlying the first extension region base and having the second conductivity type, wherein the fourth extension region riser is between the first extension region riser and the second edge of the second conductor; and
- a fourth source/drain region formed in the fourth extension region riser and connected to the voltage node, wherein the fourth source/drain region has the second conductivity type and has a conductivity level greater than a conductivity level of the fourth extension region riser.

13. The apparatus of claim 1, wherein the transistor is a first transistor, the load node is a first load node, the conductor is a first conductor, and the second dielectric is a first instance of the second dielectric, and wherein the apparatus further comprises:

- a second load node; and
- a second transistor connected between the voltage node and the second load node, the second transistor comprising:
 - a second instance of the second dielectric overlying the semiconductor;
 - a second conductor overlying the second instance of the second dielectric;
 - a third extension region base formed in the semiconductor and extending beyond a first edge of the second conductor, wherein the third extension region base has the second conductivity type;
 - a fourth extension region base formed in the semiconductor and extending beyond a second edge of the second conductor opposite the first edge of the second conductor, wherein the fourth extension region base has the second conductivity type;

a third extension region riser formed overlying the third extension region base and having the second conductivity type;

a fourth extension region riser formed overlying the fourth extension region base and having the second conductivity type;

a third source/drain region formed in the third extension region riser and connected to the voltage node, wherein the third source/drain region has the second conductivity type and has a conductivity level greater than a conductivity level of the third extension region riser; and

a fourth source/drain region formed in the fourth extension region riser and connected to the second load node, wherein the fourth source/drain region has the second conductivity type and has a conductivity level greater than a conductivity level of the fourth extension region riser.

14. The apparatus of claim 13, further comprising:

- a third conductor;
- a first contact connected to the third conductor and to the third source/drain region; and
- a second contact connected to the third conductor and to the fourth source/drain region.

15. A method of forming a transistor, comprising:

forming a semiconductor having a first conductivity type; patterning the semiconductor to define a plurality of fins of the semiconductor;

forming a plurality of plugs of a first dielectric, wherein each plug of the plurality of plugs of the first dielectric is between a pair of fins of the semiconductor of the plurality of fins of the semiconductor;

forming a second dielectric overlying the semiconductor;

forming a conductor overlying the second dielectric;

patterning the conductor to define a gate stack of the transistor;

forming a first extension region base and a second extension region base in the semiconductor, wherein the first extension region base and the second extension region base each have a second conductivity type different than the first conductivity type;

forming a first extension region riser overlying the first extension region base, wherein the first extension region riser has the second conductivity type;

forming a second extension region riser overlying the second extension region base, wherein the second extension region riser has the second conductivity type;

forming a first source/drain region in the first extension region riser, wherein the first source/drain region has the second conductivity type and has a conductivity level greater than a conductivity level of the first extension region riser; and

forming a second source/drain region in the second extension region riser, wherein the second source/drain region has the second conductivity type and has a conductivity level greater than a conductivity level of the second extension region riser.

16. The method of claim 15, wherein patterning the semiconductor to define the plurality of fins of the semiconductor comprises forming a plurality of trenches in the semiconductor.

17. The method of claim 16, wherein forming the plurality of trenches in the semiconductor comprises forming a plurality of closed trenches in the semiconductor.

18. The method of claim **15**, wherein the semiconductor comprises a first semiconductor material, and wherein forming the first extension region riser overlying the first extension region base and forming the second extension region riser overlying the second extension region base comprises:

forming a third dielectric overlying the first extension region base, the conductor and the second extension region base;

forming a first void in the third dielectric overlying the first extension region base and forming a second void in the third dielectric overlying the second extension region base; and

forming a second semiconductor material in the first void and in the second void.

19. The method of claim **18**, wherein forming the second semiconductor material comprises forming a first structure of the second semiconductor material selected from a group consisting of polycrystalline and amorphous, and converting the second semiconductor material to a single crystal lattice.

20. A memory, comprising:

an array of memory cells;

a plurality of local access lines, wherein each local access line of the plurality of local access lines is commonly connected to control gates of a respective plurality of memory cells of the array of memory cells;

a plurality of global access lines, wherein each global access line of the plurality of global access lines is selectively connected to a respective subset of local access lines of the plurality of local access lines;

a transistor connected between a first global access line of the plurality of global access lines and a first local access line of the respective subset of local access lines for the first global access line, wherein the first global access line is configured as a voltage node and the first local access line is configured as a load node; and

wherein the transistor comprises:

a semiconductor overlying a substrate, wherein the semiconductor comprises a plurality of fins overlying the substrate, and wherein the semiconductor has a first conductivity type;

a plurality of plugs of a first dielectric, wherein each plug of the plurality of plugs of the first dielectric is formed between a pair of fins of the plurality of fins of the semiconductor;

a second dielectric overlying the semiconductor;

a conductor overlying the second dielectric;

a first extension region base formed in the semiconductor and extending beyond a first edge of the conductor, wherein the first extension region base has a second conductivity type different than the first conductivity type;

a second extension region base formed in the semiconductor and extending beyond a second edge of the conductor opposite the first edge of the conductor, wherein the second extension region base has the second conductivity type;

a first extension region riser formed overlying the first extension region base and having the second conductivity type;

a second extension region riser formed overlying the second extension region base and having the second conductivity type;

a first source/drain region formed in the first extension region riser and connected to the voltage node, wherein the first source/drain region has the second conductivity type and has a conductivity level greater than a conductivity level of the first extension region riser; and

a second source/drain region formed in the second extension region riser and connected to the load node, wherein the second source/drain region has the second conductivity type and has a conductivity level greater than a conductivity level of the second extension region riser.

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