

ECLA**EUROPEAN CLASSIFICATION****H01L****SEMICONDUCTOR DEVICES; ELECTRIC SOLID STATE DEVICES NOT OTHERWISE PROVIDED FOR** (use of semiconductor devices for

measuring G01; resistors in general H01C; magnets, inductors [N: in general], transformers H01F; capacitors in general H01G; electrolytic devices [H01G9/00](#); batteries, accumulators H01M; waveguides, resonators or lines of the waveguide type H01P; line connectors, current collectors H01R; stimulated emission devices H01S; electromechanical resonators H03H; loudspeakers, microphones, gramophone pick-ups or like acoustic electromechanical transducers H04R; electric light sources in general H05B; printed circuits, hybrid circuits, casings or constructional details of electric apparatus, manufacture of assemblages of electrical components H05K; use of semiconductor devices in circuits having a particular application, see the subclass for the application) [C1112]

[N: **WARNING** [C2012.08]

1. The following IPC groups are not used in the internal ECLA classification scheme. Subject matter covered by these groups is classified in the following ECLA groups
[H01L21/301](#) covered by [H01L21/30](#)
[H01L21/328](#) covered by [H01L29/66M6](#) [H01L21/329](#) covered by [H01L29/66M6D](#)
[H01L21/33](#) covered by [H01L29/66M6T](#) [H01L21/331](#) covered by [H01L29/66M6T2](#)
[H01L21/332](#) covered by [H01L29/66M6T4](#) [H01L21/334](#) covered by [H01L29/66M6](#)
[H01L21/335](#) covered by [H01L29/66M6T6](#) [H01L21/336](#) covered by [H01L29/66M6T6F](#)
[H01L21/337](#) covered by [H01L29/66M6T6T](#) [H01L21/338](#) covered by [H01L29/66M6T6S](#) [H01L21/339](#) covered by [H01L29/66M6T9](#) [H01L21/58](#) covered by [H01L24/80](#)
[H01L21/8239](#) covered by [H01L27/105M](#) [H01L21/60](#) covered by [H01L24/80](#)
[H01L21/66](#) covered by [H01L22/34](#) [H01L21/603](#) covered by [H01L24/80](#)
[H01L21/607](#) covered by [H01L24/80](#)
[H01L21/8242](#) covered by [H01L27/108M](#)
[H01L21/8244](#) covered by [H01L27/11](#) [H01L21/8246](#) covered by [H01L27/112](#)
[H01L21/8247](#) covered by [H01L27/115F](#) [H01L21/98](#) covered by [H01L25/50](#)
[H01L29/38](#) covered by [H01L29/04](#) to [H01L29/36D](#)
[H01L29/96](#) covered by [H01L29/68](#) to [H01L29/94B](#) [H01L51/30](#) covered by [H01L51/00M](#)
[H01L51/40](#) covered by [H01L51/00A](#)
[H01L51/46](#) covered by [H01L51/00M](#)
[H01L51/48](#) covered by [H01L51/00A](#)
[H01L51/54](#) covered by [H01L51/00M](#)
2. Groups [H01L23/562](#) to [H01L23/576](#) do not correspond to former or current IPC groups. Concordance ECLA : IPC for these groups is as follows: - [H01L23/562](#) - [H01L23/564](#) : [H01L23/00](#) - [H01L23/57](#) : [H01L23/58](#)
3. Groups [H01L22/00](#) to [H01L22/64](#) do not correspond to a former or current IPC group. Concordance ECLA : IPC for these groups is as follows: - [H01L22/00](#) - [H01L22/34](#) : [H01L21/66](#)
4. Groups [H01L24/00](#) to [H01L24/98](#) do not correspond to former or current IPC groups. Concordance ECLA : IPC for these groups is as follows: - [H01L24/00](#) - [H01L24/98](#) : [H01L23/00](#)
5. Group [H01L25/50](#) does not correspond to a former or current IPC group. Concordance ECLA : IPC for this group is as follows: - [H01L25/50](#) : [H01L21/98](#)

6. Groups [H01L28/00](#) - [H01L28/92](#) do not correspond to former or current IPC groups. Concordance ECLA : IPC for these groups is as follows: - [H01L28/00](#) - [H01L28/92](#) : [H01L49/02](#)

]

Notes

1. This subclass covers electric solid state devices which are not provided for in any other subclass and details thereof. This includes:
 - semiconductor devices adapted for rectifying, amplifying, oscillating or switching;
 - semiconductor devices sensitive to radiation;
 - electric solid state devices using thermoelectric, superconductive, piezo-electric, electrostrictive, magnetostrictive, galvano-magnetic or bulk negative resistance effects and integrated circuit devices.

Also covered by this subclass are photo-resistors, magnetic field dependent resistors, field effect resistors, capacitors with potential-jump barrier, resistors with potential-jump barrier or surface barrier, incoherent light emitting diodes, electromechanical solid state transducers and thin-film or thick-film circuits. Furthermore, it provides for processes and apparatus adapted for the manufacture or treatment of such devices, except where such processes relate to single step processes for which provision exists elsewhere.
2. In this subclass:

The expression "solid state body" refers to the body of material within which, or at the surface of which, the physical effects characteristic of the device occur. In thermoelectric devices it includes all materials in the current path. Regions in or on the body of the device (other than the solid state body itself), which exert an influence on the solid state body electrically, are considered to be "electrodes" whether or not an external electrical connection is made thereto. [N: Electrodes are often referred to as "contacts" in the literature.] An electrode may include several portions and the term includes metallic regions which exert influence on the solid state body through an insulating region, (e.g. capacitive coupling) and inductive coupling arrangements to the body. The dielectric region in a capacitive arrangement is regarded as part of the electrode. In arrangements including several portions only those portions which exert an influence on the solid state body by virtue of their shape, size or disposition or the material of which they are formed are considered to be part of the electrode. The other portions are considered to be "arrangements for conducting electric current to or from the solid state body" or "interconnections between solid state components formed in or on a common substrate", i.e. leads.

The word "device" refers to an electric circuit element; where an electric circuit element is one of a plurality or elements formed in or on a common substrate it is referred to as a "component".

A "complete device" is a device in its fully assembled state which may or may not require further treatment, e.g. electro-forming, before it is ready for use but which does not require the addition of further structural units.

The word "parts" includes all structural units which are included in a complete device. A "container" is an enclosure forming part of the complete device and is essentially a solid construction in which the body of the device is placed, or which is formed around the body without forming an intimate layer thereon. An enclosure which consists of one or more layers formed on the body and in intimate contact therewith is referred to as an "encapsulation".

"Integrated circuit" is a device where all components, e.g. diodes, resistors, are built

up on a common substrate and form the device including interconnections between the components.

[N: **Note**

"Integration processes" are processes for the manufacture of at least two different components where the process is especially adapted to their integration, e.g. to take advantage of it or to reduce their manufacturing cost.

Example: in a CMOS process, the same ion implant dopes the p-MOS gate and the n-MNOS source and drain.

Consequently, a process for the manufacture of a component per se is not considered as an integration process, even though that component will be part of an integrated circuit.

"Assembly" of a device is the building up of the device from its component constructional units and includes the provision of fillings in containers.

When referring to the periodic table of the elements, either the new IUPAC notation, i.e. numbering system from 1 to 18, or the previous IUPAC form may be used to indicate an element group, e.g. group IV elements according to the previous IUPAC form correspond to group 14 elements according to the new notation

]

H01L21/00

Processes or apparatus adapted for the manufacture or treatment of semiconductor or solid state devices or of parts thereof ([N: testing or measuring during manufacture or treatment, or reliability measurements [H01L22/00](#); multistep manufacturing processes for passive two-terminal components without a potential-jump or surface barrier for integrated circuits [H01L28/00](#);) (processes or apparatus peculiar to the manufacture or treatment of devices provided for in groups [H01L31/00](#) to [H01L51/00](#) or of parts thereof, see these groups; single-step processes covered by other subclasses, see the relevant subclasses, e.g. C23C, C30B; photomechanical production of textured or patterned surfaces, materials or originals therefor, apparatus specially adapted therefor, in general G03F) [C1205]

H01L21/02

. Manufacture or treatment of semiconductor devices or of parts thereof

H01L21/02D

. . [N: Preparing wafers] [N0909]

[N: **Notes**[N0909]

1. This group covers processes for manufacturing wafers prior to the fabrication of any device, i.e. between the sawing of ingots (covered by [B28D](#)) and the cleaning of substrates (covered by [H01L21/02F](#)).

2. This group does not cover:

- simple use of grinding or polishing machines [B24B](#)

- thermal smoothening [H01L21/324](#)

]

H01L21/02D2

. . . [N: Preparing bulk and homogeneous wafers] [N0909]

[N: **WARNING**[N0909]

Not complete, see [H01L21/30](#) and subgroups

]

H01L21/02D2M

. . . . [N: Multistep processes] [N0909]

H01L21/02D2M2

. [N: Specific process step] [N0909]

H01L21/02D2M2A

. [N: Grinding, lapping] [N0911]

H01L21/02D2M2B

. [N: Backside treatment] [N0909]

- H01L21/02D2M2C [N: Chemical etching] [N0911]
- H01L21/02D2M2E [N: Edge treatment, chamfering] [N0909]
- H01L21/02D2M2P [N: Mirror polishing] [N0909] [C0911]
- H01L21/02D2O [N: Setting crystal orientation] [N0909]
- H01L21/02D2P [N: Making porous regions on the surface] [N0909]
- H01L21/02D2R [N: by reclaiming or re-processing] [N0909]
- H01L21/02D2S [N: Shaping] [N0909]
- H01L21/02D4 [N: Preparing wafers having an insulating layer, e.g. SOI wafers] [N0909]

- [N: **WARNING**[N0909]
Not complete, see [H01L21/762D](#) and subgroups
]
- H01L21/02F . . . [N: Cleaning] [N0608]
- H01L21/02F2 [N: Cleaning before device manufacture, i.e. Begin-Of-Line process] [N0608]
- H01L21/02F2B [N: Dry cleaning only (H01L21/02F12B takes precedence)] [N0608]
- H01L21/02F2B2 [N: with gaseous HF] [N0608]
- H01L21/02F2D [N: Wet cleaning only (H01L21/02F12B takes precedence)] [N0608]
- H01L21/02F2F [N: combining dry and wet cleaning steps (H01L21/02F12B takes precedence)] [N0608]
- H01L21/02F4 [N: Cleaning during device manufacture] [N0608]
- H01L21/02F4B [N: during, before or after processing of insulating layers] [N0608]
- H01L21/02F4B2 [N: the processing being the formation of vias or contact holes] [N0608]
- H01L21/02F4B4 [N: the processing being a planarization of insulating layers] [N0608]
- H01L21/02F4D [N: during, before or after processing of conductive layers, e.g. polysilicon or amorphous silicon layers] [N0608]
- H01L21/02F4D2 [N: the processing being a delineation, e.g. RIE, of conductive layers] [N0608]
- H01L21/02F4D4 [N: the processing being a planarization of conductive layers] [N0608]
- H01L21/02F6 [N: Cleaning after the substrates have been singulated] [N0608]
- H01L21/02F8 [N: Cleaning for reclaiming] [N0608]
- H01L21/02F12 [N: product to be cleaned] [N0608]
- H01L21/02F12B [N: Cleaning of diamond] [N0608]
- H01L21/02F12D [N: Cleaning of wafer edges] [N0608]
- H01L21/02F12F [N: Cleaning of wafer backside] [N0608]
- H01L21/02F12H [N: Cleaning of porous materials] [N0608]
- H01L21/02F14 [N: only mechanical cleaning] [N0608]
- H01L21/02F16 [N: only involving lasers, e.g. laser ablation] [N0608]
- H01L21/02F18 [N: only involving supercritical fluids] [N0608]
- H01L21/02K [N: Forming layers (deposition in general C23C; crystal growth in general C30B)] [N0911]

- [N: **WARNING** [N0911]
Group [H01L21/02K](#) and subgroups are not complete pending reorganisation. See also groups [H01L21/20](#), [H01L21/36](#), [H01L21/06](#), [H01L21/16](#) and subgroups
]
- H01L21/02K2 [N: Forming insulating materials on a substrate] [N0911]

[N: **WARNING** [N1104]

This group and subgroups are not complete pending the completion of a reclassification; see also [H01L21/312](#), [H01L21/314](#), [H01L21/316](#), and [H01L21/318](#) and subgroups thereof
]

- H01L21/02K2C [N: characterised by the type of layer, e.g. type of material, porous/non-porous, pre-cursors, mixtures or laminates] [N1104]
H01L21/02K2C1 [N: characterised by the material of the layer] [N1104]

[N: **Note** [N1104]

Layers comprising sublayers, i.e. multi-layers, are additionally classified in H01L 21/02KC3; porous layers are additionally classified in H01L 21/02K2C5
]

- H01L21/02K2C1G [N: the material being carbon, e.g. alpha-C, diamond or hydrogen doped carbon] [N1104]
H01L21/02K2C1J [N: carbon based polymeric organic or inorganic material, e.g. polyimides, poly cyclobutene or PVC (polymers per se C08G, photoresist per se G03F)] [N1104]
H01L21/02K2C1J2 {7 dots} [N: the material being fluoro carbon compounds, e.g. (CF_x)_n, (CH_xF_y)_n or polytetrafluoroethylene] [N1104]
H01L21/02K2C1L [N: the material containing silicon] [N1104]
H01L21/02K2C1L1 {7 dots} [N: the material containing Si, O, and at least one of H, N, C, F, or other non-metal elements, e.g. SiOC, SiOC:H or SiONC] [N1104]
H01L21/02K2C1L1B {8 dots} [N: the material being boron or phosphorus doped silicon oxides, e.g. BPSG, BSG or PSG] [N1104]
[N: **Note** [N1104]
Halogen, e.g. fluorine, containing BPSG, PSG, BSG, and the like, are additionally classified in H01L 21/02K2C1L1F
]
H01L21/02K2C1L1F {8 dots} [N: the material being halogen doped silicon oxides, e.g. FSG] [N1104]
H01L21/02K2C1L1H {8 dots} [N: the material comprising hydrogen silsesquioxane, e.g. HSQ] [N1104]
H01L21/02K2C1L1M {8 dots} [N: the material comprising alkyl silsesquioxane, e.g. MSQ] [N1104]
H01L21/02K2C1L1P {8 dots} [N: the material being a silicon oxynitride, e.g. SiON or SiON:H] [N1104]
H01L21/02K2C1L3 {7 dots} [N: the material containing silicon and at least one metal element, e.g. metal silicate based insulators or metal silicon oxynitrides] [N1104]
H01L21/02K2C1L3A {8 dots} [N: the material containing aluminium, e.g. AlSiO_x] [N1104]
H01L21/02K2C1L3H {8 dots} [N: the material containing hafnium, e.g. HfSiO_x or HfSiON] [N1104]
H01L21/02K2C1L3J {8 dots} [N: the material containing tantalum, e.g. TaSiO_x] [N1104]
H01L21/02K2C1L3M {8 dots} [N: the material containing titanium, e.g. TiSiO_x] [N1104]

H01L21/02K2C1L3R	{8 dots} [N: the material containing at least one rare earth element, e.g. silicate of lanthanides, scandium or yttrium] [N1104]
H01L21/02K2C1L3U	{8 dots} [N: the material containing zirconium, e.g. ZrSiOx] [N1104]
H01L21/02K2C1L3X	{8 dots} [N: the material containing more than one metal element] [N1104]
H01L21/02K2C1L5	{7 dots} [N: the material being a silicon oxide, e.g. SiO ₂] [N1104]
	[N: Note [N1104] The formation of silicon oxide layers is classified in this group regardless of the precursor or of the process of formation; in case of explicit statements on doping, on rest-groups, or on material components see H01L21/02K2C1L1 and subgroups; deposition of silicon oxide from organic precursors without further statements on film composition is classified here and in H01L21/02K2C7 and subgroups]
H01L21/02K2C1L7	{7 dots} [N: the material being a silicon carbide not containing oxygen, e.g. SiC, SiC:H or silicon carbonitrides (H01L21/02K2C1L1 and H01L21/02K2C1L1P take precedence)] [N1104]
H01L21/02K2C1L9	{7 dots} [N: the material being a silicon nitride not containing oxygen, e.g. SixNy or SixByNz (H01L21/02K2C1L1 and H01L21/02K2C1L1P take precedence)] [N1104]
H01L21/02K2C1M	[N: the material containing at least one metal element, e.g. metal oxides, metal nitrides, metal oxynitrides or metal carbides (materials containing silicon H01L21/02K2C1L; metal silicates H01L21/02K2C1L3)] [N1104]
H01L21/02K2C1M3	{7 dots} [N: characterised by the metal (H01L21/02K2C1M5 takes precedence)] [N1104]
H01L21/02K2C1M3A	{8 dots} [N: the material containing aluminium, e.g. Al ₂ O ₃] [N1104]
H01L21/02K2C1M3H	{8 dots} [N: the material containing hafnium, e.g. HfO ₂] [N1104]
H01L21/02K2C1M3J	{8 dots} [N: the material containing tantalum, e.g. Ta ₂ O ₅] [N1104]
H01L21/02K2C1M3M	{8 dots} [N: the material containing titanium, e.g. TiO ₂] [N1104]
H01L21/02K2C1M3P	{8 dots} [N: the material containing zirconium, e.g. ZrO ₂] [N1104]
H01L21/02K2C1M3R	{8 dots} [N: the material containing at least one rare earth metal element, e.g. oxides of lanthanides, scandium or yttrium] [N1104]
H01L21/02K2C1M3U	{8 dots} [N: the material containing more than one metal element] [N1104]
H01L21/02K2C1M5	{7 dots} [N: the material having a perovskite structure, e.g. BaTiO ₃] [N1104]
H01L21/02K2C3	[N: the layer being a laminate, i.e. composed of sublayers, e.g. stacks of alternating high-k metal oxides (adhesion layers or buffer layers H01L21/02K2T2F, H01L21/02K2T8U)] [N1104]
H01L21/02K2C5	[N: the layer being porous] [N1104]
H01L21/02K2C7	[N: the layer being characterised by the precursor material for deposition] [N1104]

- H01L21/02K2C7C [N: the precursor containing a compound comprising Si] [N1104]
- H01L21/02K2C7C2 {7 dots} [N: the compound being a silane, e.g. disilane, methylsilane or chlorosilane] [N1104]
- H01L21/02K2C7C4 {7 dots} [N: the compound comprising silicon and oxygen] [N1104]
- [N: **Note** [N1104]
This group does not cover mixtures of a silane and oxygen
]
- H01L21/02K2C7C4B {8 dots} [N: the compound being a molecule comprising at least one silicon-oxygen bond and the compound having hydrogen or an organic group attached to the silicon or oxygen, e.g. a siloxane] [N1104]
- H01L21/02K2C7C6 {7 dots} [N: the compound comprising silicon and nitrogen] [N1104]
- [N: **Note** [N1104]
This group does not cover mixtures of silane and nitrogen
]
- H01L21/02K2C7C6B {8 dots} [N: the compound being a silazane] [N1104]
- H01L21/02K2E [N: characterised by the process for the formation of the insulating layer] [N1104]
- H01L21/02K2E2 [N: formation by a process other than a deposition process] [N1104]
- [N: **Note** [N1104]
Subject matter classified in the range of [H01L21/02K2E2B](#) to [H01L21/02K2E2E](#) is additionally classified in [H01L21/02K2E2E](#), [H01L21/02K2E2J](#) and [H01L21/02K2E2G](#), depending on the type of reaction
]
- H01L21/02K2E2B [N: formation by oxidation, e.g. oxidation of the substrate] [N1104]
- H01L21/02K2E2B2 {7 dots} [N: of the semiconductor substrate or a semiconductor layer] [N1104]
- H01L21/02K2E2B2B {8 dots} [N: group IV semiconductor] [N1104]
- H01L21/02K2E2B2B2 {9 dots} [N: silicon in uncombined form, i.e. pure silicon] [N1104]
- H01L21/02K2E2B2F {8 dots} [N: III-V semiconductor] [N1104]
- H01L21/02K2E2B4 {7 dots} [N: of a metallic layer] [N1104]
- H01L21/02K2E2D [N: formation by nitridation, e.g. nitridation of the substrate] [N1104]
- H01L21/02K2E2E [N: formation by combined oxidation and nitridation performed simultaneously] [N1104]
- H01L21/02K2E2G [N: formation by plasma treatment, e.g. plasma oxidation of the substrate (after treatment of an insulating film by plasma [H01L21/3105](#) and subgroups)] [N1104]
- H01L21/02K2E2J [N: formation by thermal treatment ([H01L21/02K2E2G](#) takes precedence; after treatment of an insulating film [H01L21/3105](#) and subgroups)] [N1104]
- H01L21/02K2E2L [N: formation by anodic treatment, e.g. anodic oxidation] [N1104]
- H01L21/02K2E3 [N: formation by a deposition process (per se C23C)] [N1104]
- H01L21/02K2E3B [N: deposition from the gas or vapour phase] [N1104]
- [N: **Note** [N1104]

This group and subgroups also cover deposition methods in which the gas or vapour is produced by physical means, e.g. ablation from targets or heating of source material
]

H01L21/02K2E3B2 {7 dots} [N: deposition by physical ablation of a target, e.g. sputtering, reactive sputtering, physical vapour deposition or pulsed laser deposition] [N1104]

H01L21/02K2E3B4 {7 dots} [N: deposition by thermal evaporation, [H01L21/02K2E3N](#) takes precedence] [N1104]

[N: **Note** [N1104]

Subject matter relating to molecular beam epitaxy is classified in this group
]

H01L21/02K2E3B6 {7 dots} [N: deposition by decomposition or reaction of gaseous or vapour phase compounds, i.e. chemical vapour deposition ([H01L21/02K2E3B2](#) takes precedence)] [N1104]

H01L21/02K2E3B6B {8 dots} [N: in the presence of a plasma (PECVD)] [N1104]

H01L21/02K2E3B6D {8 dots} [N: the reactions being activated by other means than plasma or thermal, e.g. photo-CVD] [N1104]

H01L21/02K2E3B6F {8 dots} [N: deposition by cyclic CVD, e.g. ALD, ALE, pulsed CVD] [N1104]

[N: **Note** [N1104]

Subject matter relating to cyclic plasma CVD is additionally classified in H01L 21/02K2E3B6B
]

H01L21/02K2E3L [N: liquid deposition, e.g. spin-coating, sol-gel techniques, spray coating] [N1104]

H01L21/02K2E3L1 {7 dots} [N: Langmuir-Blodgett techniques] [N1104]

H01L21/02K2E3L7 {7 dots} [N: printing, e.g. ink-jet printing (per se B41J)] [N1104]

H01L21/02K2E3L9 {7 dots} [N: liquid atomic layer deposition] [N1104]

H01L21/02K2E3N [N: formation of epitaxial layers by a deposition process(epitaxial growth per se C30B)] [N1104]

[N: **Note** [N1104]

Formation of non-epitaxial layers by MBE, ALE, etc. is not covered by this group; for MBE see [H01L21/02K2E3B4](#); for ALE see [H01L21/02K2E3B6F](#)
]

H01L21/02K2T [N: characterised by the treatment performed before or after the formation of the layer ([H01L21/02K2E2](#) and subgroups take precedence)] [N1104]

[N: **Notes** [N1104]

This group and subgroups only cover processes which are directly linked to the layer formation; routine anneals, i.e. thermal treatment without further features like a special atmosphere, presence of a plasma, thermally induced chemical reactions, change of phase (crystal structure) etc. are not classified here; for cleaning see [H01L21/02F](#) and subgroups; for etching processes see [H01L21/311](#) and subgroups; for planarization processes see [H01L21/3105B](#) and subgroups; for processes to repair etch damage see [H01L21/3105](#) and subgroups
]

- H01L21/02K2T2 [N: pre-treatment] [N1104]
- [N: **Note** [N1104]
This group and subgroups cover treatments to improve adhesion or change the surface termination; for etching see [H01L21/306](#) and subgroups and [H01L21/311](#) and subgroups
]
- H01L21/02K2T2C [N: in-situ cleaning] [N1104]
- [N: **Note** [N1104]
Subject matter relating to the cleaning processes for semiconductor devices in general is covered by [H01L21/02F](#) and subgroups
]
- H01L21/02K2T2F [N: formation of intermediate layers, e.g. buffer layers, layers to improve adhesion, lattice match or diffusion barriers)] [N1104]
- H01L21/02K2T2H [N: treatment by exposure to a liquid] [N1104]
- H01L21/02K2T2J [N: treatment by exposure to electromagnetic radiation, e.g. UV light] [N1104]
- H01L21/02K2T2L [N: treatment by exposure to a gas or vapour] [N1104]
- H01L21/02K2T2L2 {7 dots} [N: treatment by exposure to a plasma] [N1104]
- H01L21/02K2T8 [N: post-treatment] [N1104] [M1202]
- [N: **Note** [N1104]
This group only covers processes that are part of the layer formation; treatments which are performed after completion of the insulating layer are covered by [H01L21/3105](#) and subgroups
]
- H01L21/02K2T8B [N: introduction of substances into an already existing insulating layer; [H01L21/02K2E2](#) and subgroups take precedence] [N1104]
- [N: **Note** [N1104]
processes like the introduction of phosphorus into silicon oxide by diffusion, or doping of an already existing insulating layer are covered by this group and subgroups; for the method of introduction, see [H01L21/02K2T8H](#), [H01L21/02K2T8J](#), [H01L21/02K2T8L](#) and subgroups
]
- H01L21/02K2T8B2 {7 dots} [N: introduction of oxygen] [N1104]
- H01L21/02K2T8B2B {8 dots} [N: into a nitride layer, e.g. changing SiN to SiON] [N1104]
- H01L21/02K2T8B4 {7 dots} [N: introduction of nitrogen] [N1104]
- H01L21/02K2T8B4B {8 dots} [N: into an oxide layer, e.g. changing SiO to SiON] [N1104]
- H01L21/02K2T8D [N: in-situ cleaning after layer formation, e.g. removing process residues (cleaning compositions per se C30D; cleaning in general B08B)] [N1104]
- [N: **Note** [N1104]
Subject matter relating to the cleaning processes for semiconductor devices in general is covered by [H01L21/02F](#) and subgroups
]
- H01L21/02K2T8H [N: treatment by exposure to a gas or vapour] [N1104]
- H01L21/02K2T8H2 {7 dots} [N: treatment by exposure to a plasma] [N1104]

H01L21/02K2T8J	. . . . .	[N: treatment by exposure to a liquid] [N1104]
H01L21/02K2T8L	. . . . .	[N: treatment by exposure to radiation, e.g. visible light] [N1104]
H01L21/02K2T8L2	. . . . .	{7 dots} [N: treatment by exposure to UV light] [N1104]
H01L21/02K2T8L4	. . . . .	{7 dots} [N: treatment by exposure to corpuscular radiation, e.g. exposure to electrons, alpha-particles, protons or ions] [N1104]
H01L21/02K2T8L6	. . . . .	{7 dots} [N: using a coherent radiation, e.g. a laser] [N1104]
H01L21/02K2T8N	. . . . .	[N: treatment to change the morphology of the insulating layer, e.g. transformation of an amorphous layer into a crystalline layer] [N1104]
H01L21/02K2T8S	. . . . .	[N: treatment to change the surface groups of the insulating layer] [N1104]
H01L21/02K2T8U	. . . . .	[N: formation of intermediate layers, e.g. capping layers or diffusion barriers] [N1104]
H01L21/02K4	. . . . .	[N: Forming inorganic semiconducting materials on a substrate (for light-sensitive devices H01L31/00)] [N0911]
H01L21/02K4A	. . . . .	[N: Substrates] [N0911]
H01L21/02K4A1	. . . . .	[N: Materials] [N0911]
H01L21/02K4A1A	. . . . .	[N: Group 14 semiconducting materials] [N0911]
H01L21/02K4A1A1	. . . . .	{7 dots} [N: Carbon, e.g. diamond-like carbon] [N0911]
H01L21/02K4A1A2	. . . . .	{7 dots} [N: Silicon carbide] [N0911]
H01L21/02K4A1A3	. . . . .	{7 dots} [N: Silicon, silicon germanium, germanium] [N0911]
H01L21/02K4A1A4	. . . . .	{7 dots} [N: including tin] [N0911]
H01L21/02K4A1B	. . . . .	[N: Group 13/15 materials] [N0911]
H01L21/02K4A1B1	. . . . .	{7 dots} [N: Nitrides] [N0911]
H01L21/02K4A1B2	. . . . .	{7 dots} [N: Phosphides] [N0911]
H01L21/02K4A1B3	. . . . .	{7 dots} [N: Arsenides] [N0911]
H01L21/02K4A1B4	. . . . .	{7 dots} [N: Antimonides] [N0911]
H01L21/02K4A1C	. . . . .	[N: Group 12/16 materials] [N0911]
H01L21/02K4A1C1	. . . . .	{7 dots} [N: Oxides] [N0911]
H01L21/02K4A1C2	. . . . .	{7 dots} [N: Sulfides] [N0911]
H01L21/02K4A1C3	. . . . .	{7 dots} [N: Selenides] [N0911]
H01L21/02K4A1C4	. . . . .	{7 dots} [N: Tellurides] [N0911]
H01L21/02K4A1D	. . . . .	[N: Oxide semiconducting materials not being Group 12/16 materials, e.g. ternary compounds] [N0911]
H01L21/02K4A1E	. . . . .	[N: Chalcogenide semiconducting materials not being oxides, e.g. ternary compounds] [N0911]
H01L21/02K4A1J	. . . . .	[N: Crystalline insulating materials] [N0911]
H01L21/02K4A1K	. . . . .	[N: Non-crystalline insulating materials, e.g. glass, polymers] [N0911]
H01L21/02K4A1L	. . . . .	[N: Conductive materials, e.g. metallic silicides] [N0911]
H01L21/02K4A5	. . . . .	[N: Structure] [N0911]
H01L21/02K4A5S	. . . . .	[N: Surface structure] [N0911]
H01L21/02K4A7	. . . . .	[N: Crystal orientation] [N0911]
H01L21/02K4B	. . . . .	[N: Intermediate layers between substrates and deposited layers] [N0911]
H01L21/02K4B1	. . . . .	[N: Materials] [N0911]
H01L21/02K4B1A	. . . . .	[N: Group 14 semiconducting materials] [N0911]

H01L21/02K4B1A1	. . . . .	{7 dots} [N: Carbon, e.g. diamond-like carbon] [N0911]
H01L21/02K4B1A2	. . . . .	{7 dots} [N: Silicon carbide] [N0911]
H01L21/02K4B1A3	. . . . .	{7 dots} [N: Silicon, silicon germanium, germanium] [N0911]
H01L21/02K4B1A4	. . . . .	{7 dots} [N: including tin] [N0911]
H01L21/02K4B1B	. . . . .	[N: Group 13/15 materials] [N0911]
H01L21/02K4B1B1	. . . . .	{7 dots} [N: Nitrides] [N0911]
H01L21/02K4B1B2	. . . . .	{7 dots} [N: Phosphides] [N0911]
H01L21/02K4B1B3	. . . . .	{7 dots} [N: Arsenides] [N0911]
H01L21/02K4B1B4	. . . . .	{7 dots} [N: Antimonides] [N0911]
H01L21/02K4B1C	. . . . .	[N: Group 12/16 materials] [N0911]
H01L21/02K4B1C1	. . . . .	{7 dots} [N: Oxides] [N0911]
H01L21/02K4B1C2	. . . . .	{7 dots} [N: Sulfides] [N0911]
H01L21/02K4B1C3	. . . . .	{7 dots} [N: Selenides] [N0911]
H01L21/02K4B1C4	. . . . .	{7 dots} [N: Tellurides] [N0911]
H01L21/02K4B1D	. . . . .	[N: Oxide semiconducting materials not being Group 12/16 materials, e.g. ternary compounds] [N0911]
H01L21/02K4B1E	. . . . .	[N: Other chalcogenide semiconducting materials not being oxides, e.g. ternary compounds] [N0911]
H01L21/02K4B1J	. . . . .	[N: Insulating materials] [N0911]
H01L21/02K4B1L	. . . . .	[N: Conductive materials] [N0911]
H01L21/02K4B5	. . . . .	[N: Structure] [N0911]
H01L21/02K4B5L	. . . . .	[N: Layer structure] [N0911]
H01L21/02K4B5L1	. . . . .	{7 dots} [N: Monolayers] [N0911]
H01L21/02K4B5L2	. . . . .	{7 dots} [N: consisting of two layers] [N0911]
H01L21/02K4B5L3	. . . . .	{7 dots} [N: consisting of more than two layers] [N0911]
H01L21/02K4B5L3A	. . . . .	{8 dots} [N: Alternating layers, e.g. superlattice] [N0911]
H01L21/02K4B5L7	. . . . .	{7 dots} [N: Graded layers] [N0911]
H01L21/02K4B5M	. . . . .	[N: Microstructure] [N0911]
H01L21/02K4B7	. . . . .	[N: Crystal orientation] [N0911]
H01L21/02K4C	. . . . .	[N: Deposited layers] [N0911]
H01L21/02K4C1	. . . . .	[N: Materials] [N0911]
H01L21/02K4C1A	. . . . .	[N: Group 14 semiconducting materials] [N0911]
H01L21/02K4C1A1	. . . . .	{7 dots} [N: Carbon, e.g. diamond-like carbon] [N0911]
H01L21/02K4C1A2	. . . . .	{7 dots} [N: Silicon carbide] [N0911]
H01L21/02K4C1A3	. . . . .	{7 dots} [N: Silicon, silicon germanium, germanium] [N0911]
H01L21/02K4C1A4	. . . . .	{7 dots} [N: including tin] [N0911]
H01L21/02K4C1B	. . . . .	[N: Group 13/15 materials] [N0911]
H01L21/02K4C1B1	. . . . .	{7 dots} [N: Nitrides] [N0911]
H01L21/02K4C1B2	. . . . .	{7 dots} [N: Phosphides] [N0911]
H01L21/02K4C1B3	. . . . .	{7 dots} [N: Arsenides] [N0911]
H01L21/02K4C1B4	. . . . .	{7 dots} [N: Antimonides] [N0911]
H01L21/02K4C1C	. . . . .	[N: Group 12/16 materials] [N0911]
H01L21/02K4C1C1	. . . . .	{7 dots} [N: Oxides] [N0911]

H01L21/02K4C1C2	. . . . .	{7 dots} [N: Sulfides] [N0911]
H01L21/02K4C1C3	. . . . .	{7 dots} [N: Selenides] [N0911]
H01L21/02K4C1C4	. . . . .	{7 dots} [N: Tellurides] [N0911]
H01L21/02K4C1D	. . . . .	[N: Oxide semiconducting materials not being Group 12/16 materials, e.g. ternary compounds] [N0911]
H01L21/02K4C1E	. . . . .	[N: Chalcogenide semiconducting materials not being oxides, e.g. ternary compounds] [N0911]
H01L21/02K4C3	. . . . .	[N: Doping during depositing] [N0911]
H01L21/02K4C3C	. . . . .	[N: Conductivity type] [N0911]
H01L21/02K4C3C1	. . . . .	{7 dots} [N: N-type] [N0911]
H01L21/02K4C3C2	. . . . .	{7 dots} [N: P-type] [N0911]
H01L21/02K4C3C8	. . . . .	{7 dots} [N: Transition metal or rare earth elements] [N0911] [C1204]
H01L21/02K4C3D	. . . . .	[N: Delta-doping] [N0911]
H01L21/02K4C5	. . . . .	[N: Structure] [N0911]
H01L21/02K4C5M	. . . . .	[N: Microstructure] [N0911]
H01L21/02K4C5M1	. . . . .	{7 dots} [N: amorphous] [N0911]
H01L21/02K4C5M2	. . . . .	{7 dots} [N: polycrystalline] [N0911]
H01L21/02K4C5M3	. . . . .	{7 dots} [N: monocrystalline] [N0911]
H01L21/02K4C5M5	. . . . .	{7 dots} [N: Nanoparticles (fullerenes H01L51/00M4B)] [N0911]
H01L21/02K4C5M6	. . . . .	{7 dots} [N: Nanowires] [N0911]
H01L21/02K4C5M7	. . . . .	{7 dots} [N: Nanotubes (carbon nanotubes H01L51/00M4D)] [N0911]
H01L21/02K4C7	. . . . .	[N: Crystal orientation] [N0911]
H01L21/02K4E	. . . . .	[N: Formation types] [N0911]
H01L21/02K4E2	. . . . .	[N: Transformation of metal, e.g. oxidation, nitridation] [N0911]
H01L21/02K4E3	. . . . .	[N: Deposition types] [N0911]
H01L21/02K4E3C	. . . . .	[N: Reduction or decomposition of gaseous compounds, e.g. CVD] [N0911]
H01L21/02K4E3L	. . . . .	[N: Liquid deposition] [N0911]
H01L21/02K4E3L3	. . . . .	{7 dots} [N: using melted materials] [N0911]
H01L21/02K4E3L5	. . . . .	{7 dots} [N: using solutions] [N0911]
H01L21/02K4E3P	. . . . .	[N: Physical deposition at reduced pressure, e.g. MBE, sputtering, evaporation] [N0911]
H01L21/02K4E3Q	. . . . .	[N: Homoepitaxy] [N0911]
H01L21/02K4E3S	. . . . .	[N: Selective deposition, e.g. simultaneous growth of mono- and non-monocrystalline semiconductor materials] [N0911]
H01L21/02K4E3S3	. . . . .	{7 dots} [N: Preparation of substrate for selective deposition] [N0911]
H01L21/02K4E3S3M	. . . . .	{8 dots} [N: Mask materials other than SiO ₂ or SiN] [N0911]
H01L21/02K4E3S3S	. . . . .	{8 dots} [N: Seed materials] [N0911]
H01L21/02K4E3S7	. . . . .	{7 dots} [N: Lateral overgrowth] [N0911]
H01L21/02K4E3S7P	. . . . .	{8 dots} [N: Pendeoepitaxy] [N0911]
H01L21/02K4E3S8	. . . . .	{7 dots} [N: Vapour-liquid-solid growth] [N0911]

H01L21/02K4T	. . . . .	[N: Special treatments] [N0911]
H01L21/02K4T2	. . . . .	[N: Pretreatments (cleaning in general H01L21/02F)] [N0911]
H01L21/02K4T2D	. . . . .	[N: In-situ cleaning] [N0911]
H01L21/02K4T8	. . . . .	[N: Aftertreatments (planarisation in general H01L21/304)] [N0911]
H01L21/02K4T8C	. . . . .	[N: Crystallisation or recrystallisation of non-monocrystalline semiconductor materials, e.g. regrowth] [N0911]
H01L21/02K4T8C1	. . . . .	{7 dots} [N: using crystallisation inhibiting elements] [N0911]
H01L21/02K4T8C3	. . . . .	{7 dots} [N: using crystallisation enhancing elements] [N0911]
H01L21/02K4T8C5	. . . . .	{7 dots} [N: using laser beams] [N0911]
H01L21/02K4T8C5B	. . . . .	{8 dots} [N: Beam shaping, e.g. using a mask] [N0911]
H01L21/02K4T8C5B2	. . . . .	{9 dots} [N: Shape of mask] [N0911]
H01L21/02K4T8C5C	. . . . .	{8 dots} [N: Continuous wave laser beam] [N0911]
H01L21/02K4T8C5P	. . . . .	{8 dots} [N: Pulsed laser beam] [N0911]
H01L21/02K4T8C6	. . . . .	{7 dots} [N: using particle beams] [N0911]
H01L21/02K4T8C8	. . . . .	{7 dots} [N: Scanning of a beam] [N0911]
H01L21/02K4T8I	. . . . .	[N: Controlling the interface between substrate and epitaxial layer, e.g. by ion implantation followed by annealing] [N0911]
H01L21/02K6	. . . . .	[N: Forming conducting materials on a substrate] [N0911]
H01L21/027	. . . . .	Making masks on semiconductor bodies for further photolithographic processing not provided for in group H01L21/18 or H01L21/34 [N: (photographic masks or originals per se G03F1/00 ; registration or positioning of photographic masks or originals G03F9/00 ; photographic cameras G03B ; control of position G05D3/00)]
H01L21/027B	. . . . .	[N: comprising organic layers]
H01L21/027B2	. . . . .	[N: for lift-off processes]
H01L21/027B6	. . . . .	[N: characterised by the treatment of photoresist layers]
H01L21/027B6B	. . . . .	[N: Photolithographic processes]
H01L21/027B6B2	. . . . .	[N: using lasers]
H01L21/027B6B4	. . . . .	[N: using an anti-reflective coating (anti-reflective coating for lithography in general G03F7/09)]
H01L21/027B6C	. . . . .	[N: Electrolithographic processes]
H01L21/027B6D	. . . . .	[N: Röntgenlithographic or X-ray lithographic processes]
H01L21/027B6E	. . . . .	[N: Ionlithographic processes]
H01L21/033	. . . . .	comprising inorganic layers
H01L21/033B	. . . . .	[N: for lift-off processes]
H01L21/033D	. . . . .	[N: characterised by their composition, e.g. multilayer masks, materials]
H01L21/033F	. . . . .	[N: characterised by their size, orientation, disposition, behaviour, shape, in horizontal or vertical plane]
H01L21/033F2	. . . . .	[N: characterised by their behaviour during the process, e.g. soluble masks, redeposited masks]
H01L21/033F4	. . . . .	[N: characterised by the process involved to create the mask, e.g. lift-off masks, sidewalls, or to modify the mask, e.g. pre-treatment, post-treatment]
H01L21/033F6	. . . . .	[N: Process specially adapted to improve the resolution of the mask]
H01L21/04	. . . . .	the devices having at least one potential-jump barrier or surface barrier, e.g. PN junction, depletion layer, carrier concentration layer [N: (multistep processes specially adapted for the manufacture of said devices H01L29/66M , H01L29/40M);

- details of semiconductor bodies [H01L29/02](#)] [C1203]
- H01L21/04D [N: the devices having semiconductor bodies comprising semiconducting carbon, e.g. diamond, diamond-like carbon (multistep processes for the manufacture of said devices [H01L29/66M2](#))] [N9907] [C1202]
- [N: **Note**
This group covers passivation
]
- H01L21/04D10 [N: Making n- or p-doped regions] [N9907]
- H01L21/04D10B [N: using ion implantation] [N9907]
- H01L21/04D16 N: Changing their shape, e.g. forming recesses (etching of the semiconductor body [H01L21/302](#))] [N9907] [C1203]
- H01L21/04D20 [N: Making electrodes] [N9907]
- H01L21/04D20A [N: Ohmic electrodes] [N9907]
- H01L21/04D20C [N: Schottky electrodes] [N9907]
- H01L21/04D20E [N: Conductor-insulator-semiconductor electrodes] [N9907]
- H01L21/04H [N: the devices having semiconductor bodies comprising crystalline silicon carbide (multistep processes for the manufacture of said devices [H01L29/66M4](#))] [N9611] [C1203]
- H01L21/04H2 [N: passivating silicon carbide surfaces] [N0110]
- H01L21/04H4 [N: Making n or p doped regions or layers, e.g. using diffusion] [N0110]
- H01L21/04H4A [N: using ion implantation] [N0110]
- [N: **Note**
Processes where ion implantation of boron and subsequent annealing does not produce a p-doped region are classified elsewhere, e.g. [H01L21/04H](#)
]
- H01L21/04H4A10 [N: using masks] [N0110]
- H01L21/04H4A12 [N: characterised by the angle between the ion beam and the crystal planes or the main crystal surface] [N0110]
- H01L21/04H6 [N: Changing the shape of the semiconductor body, e.g. forming recesses, (etching of the semiconductor body [H01L21/302](#))] [N0110] [C1203]
- H01L21/04H10 [N: Making electrodes] [N9611]
- H01L21/04H10A [N: Ohmic electrodes] [N9611]
- H01L21/04H10B [N: Conductor-insulator-semiconductor electrodes, e.g. MIS contacts] [N9611]
- H01L21/04H10C [N: Schottky electrodes] [N9611]
- H01L21/06 the devices having semiconductor bodies comprising selenium or tellurium in uncombined form other than as impurities in semiconductor bodies of other materials
- [N: **WARNING** [N0911]
This group is no longer used for the classification of new documents as from December 1, 2009. The backlog of this group is being continuously reclassified to [H01L21/02K4](#) and subgroups
]
- H01L21/08 Preparation of the foundation plate
- H01L21/10 Preliminary treatment of the selenium or tellurium, its application to the foundation plate, or the subsequent treatment of the combination

- H01L21/10B [N: Application of the selenium or tellurium to the foundation plate]
- H01L21/103 Conversion of the selenium or tellurium to the conductive state
- H01L21/105 Treatment of the surface of the selenium or tellurium layer after having been made conductive
- H01L21/108 Provision of discrete insulating layers, i.e. non-genetic barrier layers
- H01L21/12 Application of an electrode to the exposed surface of the selenium or tellurium after the selenium or tellurium has been applied to the foundation plate
- H01L21/14 Treatment of the complete device, e.g. by electroforming to form a barrier
- H01L21/145 Ageing
- H01L21/16 the devices having semiconductor bodies comprising cuprous oxide or cuprous iodide

[N: **WARNING** [N0911]

This group is no longer used for the classification of new documents as from December 1, 2009. The backlog of this group is being continuously reclassified to [H01L21/02K4](#) and subgroups]

- H01L21/16B [N: Preparation of the foundation plate, preliminary treatment oxidation of the foundation plate, reduction treatment]
- H01L21/16B2 [N: Preliminary treatment of the foundation plate]
- H01L21/16B3 [N: Oxidation and subsequent heat treatment of the foundation plate ([H01L21/16B4](#) takes precedence)]
- H01L21/16B4 [N: Reduction of the copper oxide, treatment of the oxide layer]
- H01L21/16B5 [N: Application of a non-genetic conductive layer]
- H01L21/16C [N: Treatment of the complete device, e.g. electroforming, ageing]
- H01L21/18 the devices having semiconductor bodies comprising elements of the fourth group of the Periodic System or AIIIBV compounds with or without impurities, e.g. doping materials [N: ([H01L21/04D10](#) to [H01L21/04D20](#), [H01L21/04H2](#) to [H01L21/04H10](#) take precedence)] [C1203]

Note

This group covers also processes and apparatus which, by using the appropriate technology, are clearly suitable for manufacture or treatment of devices whose bodies comprise elements of the fourth group of the Periodic System or AIIIBV compounds, even if the material used is not explicitly specified.

- H01L21/18A [N: Intermixing or interdiffusion or disordering of III-V heterostructures, e.g. IILD] [N9607]
- H01L21/18B [N: Joining of semiconductor bodies for junction formation]
- H01L21/18B2 [N: by direct bonding] [N9703]
- H01L21/20 Deposition of semiconductor materials on a substrate, e.g. epitaxial growth [N: solid phase epitaxy] [C9907]

[N: **WARNING** [N0911]

This group is no longer used for the classification of new documents as from December 1, 2009. The backlog of this group is being continuously reclassified to [H01L21/02K4](#) and subgroups]

- H01L21/20B [N: Characterised by the substrate ([H01L21/203](#), [H01L21/205](#), [H01L21/208](#) take precedence)]

H01L21/20B2	. . . . .	[N: Bonding of semiconductor wafers to insulating substrates or to semiconducting substrates using an intermediate insulating layer (H01L21/20B4 takes precedence; bonding of semiconductor wafers to semiconductor wafers for junction formation H01L21/18B2)] [C9708]
H01L21/20B4	. . . . .	[N: the substrate being of crystalline insulating material, e.g. sapphire]
H01L21/20B6	. . . . .	[N: the substrate being of crystalline semiconductor material, e.g. lattice adaptation, heteroepitaxy]
H01L21/20C	. . . . .	[N: Selective epilaxial growth, e.g. simultaneous deposition of mono - and non-mono semiconductor materials] [C9709]
H01L21/20D	. . . . .	[N: Epitaxial regrowth of non-monocrystalline semiconductor materials, e.g. lateral epitaxy by seeded solidification, solid-state crystallization, solid-state graphoepitaxy, explosive crystallization, grain growth in polycrystalline materials]
H01L21/20D2	. . . . .	[N: using a coherent energy beam, e.g. laser or electron beam] [N9708]
H01L21/203	. . . . .	using physical deposition, e.g. vacuum deposition, sputtering
H01L21/203B	. . . . .	[N: Epitaxial deposition of elements of the Fourth Group of the Periodic System, e.g. Si, Ge]
H01L21/203C	. . . . .	[N: Epitaxial deposition of AIII BV compounds]
H01L21/205	. . . . .	using reduction or decomposition of a gaseous compound yielding a solid condensate, i.e. chemical deposition
H01L21/205B	. . . . .	[N: Epitaxial deposition of elements of the Fourth Group of the Periodic System, e.g. Si, Ge]
H01L21/205C	. . . . .	[N: Epitaxial deposition of AIIIBV compounds]
H01L21/208	. . . . .	using liquid deposition
H01L21/208C	. . . . .	[N: Epitaxial deposition of AIIIBV compounds]
H01L21/22	. . . . .	Diffusion of impurity materials, e.g. doping materials, electrode materials, into or out of a semiconductor body, or between semiconductor regions; [N: Interactions between two or more impurities; Redistribution of impurities] [C9907]
H01L21/22C	. . . . .	[N: from the substrate during epitaxy, e.g. autodoping; Preventing or using autodoping] [C9905]
H01L21/22D	. . . . .	[N: of killers]
H01L21/22D2	. . . . .	[N: in AIIIBV compounds]
H01L21/22L	. . . . .	[N: Lithium-drift]
H01L21/22N	. . . . .	[N: Diffusion sources]
H01L21/223	. . . . .	using diffusion into or out of a solid from or into a gaseous phase [N: (H01L21/22D to H01L21/22L take precedence; diffusion through an applied layer H01L21/225)] [C9701]
H01L21/223B	. . . . .	[N: Diffusion into or out of AIIIBV compounds]
H01L21/223E	. . . . .	[N: from or into a plasma phase]
H01L21/225	. . . . .	using diffusion into or out of a solid from or into a solid phase, e.g. a doped oxide layer [N: (H01L21/22D to H01L21/22L take precedence)] [C9701]
H01L21/225A	. . . . .	[N: Diffusion into or out of group IV semiconductors]
H01L21/225A2	. . . . .	{7 dots} [N: using predeposition of impurities into the semiconductor surface, e.g. from a gaseous phase]
H01L21/225A2D	. . . . .	{8 dots} [N: by ion implantation]

[N: Note

In groups [H01L21/225A4](#) to [H01L21/225A4F](#) one should consider the main compositional parts of the applied layer just before the diffusion step

]

H01L21/225A4	. . . . .	{7 dots} [N: from or through or into an applied layer, e.g. photoresist, nitrides]
H01L21/225A4D	. . . . .	{8 dots} [N: the applied layer comprising oxides only, e.g. P2O5, PSG, H3BO3, doped oxides]
H01L21/225A4D2	. . . . .	{9 dots} [N: through the applied layer] [N9603]
H01L21/225A4F	. . . . .	{8 dots} [N: the applied layer being silicon or silicide or SIPOS, e.g. polysilicon, porous silicon]
H01L21/225B	. . . . .	[N: Diffusion into or out of AIIIBV compounds]
H01L21/228	. . . . .	using diffusion into or out of a solid from or into a liquid phase, e.g. alloy diffusion processes [N: (H01L21/22D to H01L21/22L take precedence)] [C9701]
H01L21/24	. . . . .	Alloying of impurity materials, e.g. doping materials, electrode materials, with a semiconductor body [N: (H01L21/18A takes precedence)] [C9607]
H01L21/24B	. . . . .	[N: Alloying of doping materials with AIIIBV compounds]
H01L21/24C	. . . . .	[N: Alloying of electrode materials]
H01L21/24C2	. . . . .	[N: with AIIIBV compounds]
H01L21/24D	. . . . .	[N: Apparatus specially adapted for the alloying]
H01L21/26	. . . . .	Bombardment with radiation [N: (H01L21/3105 takes precedence)] [C9907]
H01L21/26C	. . . . .	[N: using natural radiation, e.g. alpha, beta or gamma radiation]
H01L21/261	. . . . .	to produce a nuclear reaction transmuted chemical elements [N9607]
H01L21/263	. . . . .	with high-energy radiation (H01L21/261 takes precedence) [C9607]
H01L21/263B	. . . . .	[N: for etching, e.g. sputteretching]
H01L21/263C	. . . . .	[N: for heating, e.g. electron beam heating]
H01L21/265	. . . . .	producing ion implantation (ion beam tubes for localised treatment H01J37/30)

[N: WARNING

[N1203]The groups [H01L21/265C](#), [H01L21/265E](#) and [H01L21/265L](#) are not complete, see provisionally also [H01L21/265A](#) and [H01L21/265B](#) and their subgroups

]

H01L21/265A	. . . . .	{7 dots} [N: in group IV semiconductors] [C9903]
H01L21/265A2	. . . . .	{8 dots} [N: of electrically active species]
H01L21/265A2B	. . . . .	{9 dots} [N: Through-implantation]
H01L21/265A3	. . . . .	{8 dots} [N: Recoil-implantation]
H01L21/265A4	. . . . .	{8 dots} [N: of electrically inactive species in silicon to make buried insulating layers] [N9703]
H01L21/265B	. . . . .	{7 dots} [N: in AIIIBV compounds]
H01L21/265B2	. . . . .	{8 dots} [N: of electrically active species]
H01L21/265B2B	. . . . .	{9 dots} [N: Through-implantation]
H01L21/265B3	. . . . .	{8 dots} [N: characterised by the implantation of both electrically active and inactive species in the same semiconductor region to

		be doped]
H01L21/265C	. . . . .	{7 dots} [N: of a cluster, e.g. using a gas cluster ion beam] [N1204]
H01L21/265E	. . . . .	{7 dots} [N: of a molecular ion, e.g. decaborane] [N1204]
H01L21/265F	. . . . .	{7 dots} [N: characterised by the angle between the ion beam and the crystal planes or the main crystal surface]
H01L21/265L	. . . . .	{7 dots} [N: at a temperature lower than room temperature] [N1204]
H01L21/266	. . . . .	{7 dots} using masks [N: (H01L21/265F takes precedence)]
H01L21/268	. . . . .	using electromagnetic radiation, e.g. laser radiation
H01L21/268B	. . . . .	{7 dots} [N: using X-ray lasers]
H01L21/268C	. . . . .	{7 dots} [N: using incoherent radiation]
H01L21/28	. . . . .	Manufacture of electrodes on semiconductor bodies using processes or apparatus not provided for in H01L21/20 to H01L21/268 ; [N: etching for patterning the electrodes H01L21/311 and H01L21/3213] [C9905]
H01L21/28E	. . . . .	[N: Making conductor-insulator-semiconductor electrodes] [N9607]
H01L21/28E2	. . . . .	[N: the insulator being formed after the semiconductor body, the semiconductor being silicon] [N9607] [C9905]
		[N: Notes [N0911] This group covers deposition of the insulators, including epitaxial insulators, and the conductors within the same process or chamber]
H01L21/28E2B	. . . . .	{7 dots} [N: characterised by the conductor (H01L21/28E2C2B takes precedence)] [N9607]
		[N: Note When the final conductor comprises a superconductor, subject matter is not classified according to the subgroups H01L21/28E2B2 to H01L21/28E2B7 . Instead, it is classified in H01L21/28E2B]
H01L21/28E2B2	. . . . .	{8 dots} [N: the final conductor layer next to the insulator being silicon, e.g. polysilicon, with or without impurities (H01L21/28E2B8 takes precedence)] [N9908]
		[N: Note A very thin, e.g. silicon, adhesion or seed layer is not considered as the one next to the insulator]
H01L21/28E2B2P	. . . . .	{9 dots} [N: the conductor comprising at least another non-silicon conductive layer] [N9908]
H01L21/28E2B2P3	. . . . .	{10 dots} [N: the conductor comprising a silicide layer formed by the silicidation reaction of silicon with a metal layer (formed by metal ion implantation H01L21/28E2B2P)] [N9908]
H01L21/28E2B2P4	. . . . .	{10 dots} [N: the conductor comprising a metal or metallic silicide formed by deposition, e.g. sputter deposition, i.e. without a silicidation reaction (H01L21/28E2B2P3 takes precedence)] [N9908]
		[N: Note To assess the coverage of groups H01L21/28E2B2P3 and H01L21/28E2B2P4 , barrier layers, e.g. TaSiN, are

		not considered]
H01L21/28E2B4	. . . . .	{8 dots} [N: the final conductor layer next to the insulator being Si or Ge or C and their alloys except Si] [N9908]
H01L21/28E2B5	. . . . .	{8 dots} [N: the final conductor layer next to the insulator being a single metal, e.g. Ta, W, Mo, Al] [N9908]
H01L21/28E2B6	. . . . .	{8 dots} [N: the final conductor layer next to the insulator being a composite, e.g. TiN] [N9908]
H01L21/28E2B7	. . . . .	{8 dots} [N: the final conductor layer next to the insulator being a metallic silicide] [N9908]
H01L21/28E2B8	. . . . .	{8 dots} [N: the final conductor next to the insulator having a lateral composition or doping variation, or being formed laterally by more than one deposition step] [N9908]
H01L21/28E2B20	. . . . .	{8 dots} [N: characterised by the sectional shape, e.g. T, inverted-T] [N9908]
		[N: Note Documents are also classified in groups H01L21/28E2B2 to H01L21/28E2B8 when the composition is also relevant]
H01L21/28E2B30	. . . . .	{8 dots} [N: Lithography-related aspects, e.g. sub-lithography lengths; Isolation-related aspects, e.g. to solve problems arising at the crossing with the side of the device isolation; Planarisation aspects] [N9908]
H01L21/28E2B30D	. . . . .	{9 dots} [N: conducting part of electrode is defined by a sidewall spacer or a similar technique, e.g. oxidation under mask, plating] [N0409]
H01L21/28E2B30R	. . . . .	{9 dots} [N: insulating part of the electrode is defined by a sidewall spacer, e.g. dummy spacer, or a similar technique, e.g. oxidation under mask, plating] [N0409]
H01L21/28E2B30S	. . . . .	{9 dots} [N: part or whole of the electrode is a sidewall spacer or made by a similar technique, e.g. transformation under mask, plating] [N0409]
H01L21/28E2C	. . . . .	{7 dots} [N: Making the insulator] [N9607] [C0605]
H01L21/28E2C2	. . . . .	{8 dots} [N: on single crystalline silicon, e.g. using a liquid, i.e. chemical oxidation] [N9607] [C0605]
H01L21/28E2C2B	. . . . .	{9 dots} [N: with a treatment, e.g. annealing, after the formation of the definitive gate conductor] [N9607] [C0605]
H01L21/28E2C2C	. . . . .	{9 dots} [N: with a treatment, e.g. annealing, after the formation of the gate insulator and before the formation of the definitive gate conductor] [N0601]
H01L21/28E2C2D	. . . . .	{9 dots} [N: by deposition, e.g. evaporation, ALD, CVD, sputtering, laser deposition (H01L21/28E2C2N takes precedence)] [N0601]
H01L21/28E2C2N	. . . . .	{9 dots} [N: in a nitrogen-containing ambient, e.g. nitride deposition, growth, oxynitridation, NH3 nitridation, N2O oxidation, thermal nitridation, RTN, plasma nitridation, RPN] [N0601]
H01L21/28E2C2V	. . . . .	{9 dots} [N: in a gaseous ambient using an oxygen or a water vapour, e.g. RTO, possibly through a layer (H01L21/28E2C2D and H01L21/28E2C2N take

		ence)] [N0601] [N: Note: thin oxidation layers used as a barrier layer or as a buffer layer, e.g. before the formation of a high-k insulator, are classified here only if important per se]
H01L21/28E2C3	. . . . .	{8 dots} [N: with substrate doping, e.g. N, Ge, C implantation, before formation of the insulator] [N0601]
H01L21/28E2C4	. . . . .	{8 dots} [N: by deposition of a layer, e.g. metal, metal compound or polysilicon, followed by transformation thereof into an insulating layer] [N0601]
H01L21/28E2C5	. . . . .	{8 dots} [N: with sacrificial oxide] [N0601]
H01L21/28E2P	. . . . .	{7 dots} [N: passivation or protection of the electrode, e.g. using re-oxidation] [N0409]
H01L21/28E3	. . . . .	[N: the insulator being formed after the semiconductor body, the semiconductor belonging to the fourth group and not being elemental silicon, e.g. Ge, SiGe, SiGeC] [N0204]
H01L21/28E4	. . . . .	[N: the insulator being formed after the semiconductor body, the semiconductor being a III-V compound] [N0409]
H01L21/28F	. . . . .	[N: Making conductor-insulator-conductor-insulator-semiconductor electrodes (H01L21/28K takes precedence)] [N0010]
H01L21/28G	. . . . .	[N: comprising a charge trapping insulator] [N0010]
H01L21/28K	. . . . .	[N: comprising a layer which is used for its ferroelectric properties] [N0010]
H01L21/283	. . . . .	Deposition of conductive or insulating materials for electrodes [N: conducting electric current]
H01L21/285	. . . . .	from a gas or vapour, e.g. condensation
H01L21/285B	. . . . .	{7 dots} [N: of conductive layers]
H01L21/285B4	. . . . .	{8 dots} [N: on semiconductor bodies comprising elements of the fourth group of the Periodic System]
H01L21/285B4A	. . . . .	{9 dots} [N: the conductive layers comprising silicides (H01L21/285B4C takes precedence)] [N9410] [C0011]
H01L21/285B4B	. . . . .	{9 dots} [N: the conductive layers comprising semiconducting material (H01L21/285B4A , H01L21/285B4C take precedence)] [C0011]
H01L21/285B4B2	. . . . .	{10 dots} [N: Making of side-wall contacts]
H01L21/285B4C	. . . . .	{9 dots} [N: Deposition of Schottky electrodes] [C0011]
H01L21/285B4F	. . . . .	{9 dots} [N: by physical means, e.g. sputtering, evaporation (H01L21/285B4A to H01L21/285B4C and H01L21/285B4L take precedence)] [N9810] [C0011]
H01L21/285B4H	. . . . .	{9 dots} [N: by chemical means, e.g. CVD, LPCVD, PECVD, laser CVD (H01L21/285B4A to H01L21/285B4C and H01L21/285B4L take precedence)] [N9810] [C0011]
H01L21/285B4H2	. . . . .	{10 dots} [N: Selective deposition] [N9810]
H01L21/285B4L	. . . . .	{9 dots} [N: the conductive layers comprising transition metals (H01L21/285B4A takes precedence)] [N9810] [C0103]
H01L21/285B6	. . . . .	{8 dots} [N: on semiconductor bodies comprising AlIBV compounds]
H01L21/285B6B	. . . . .	{9 dots} [N: Deposition of Schottky electrodes]
H01L21/285B6C	. . . . .	{9 dots} [N: characterised by the sectional shape, e.g. T, inverted T] [N0409]

H01L21/285B6C2	. . . . .	{10 dots} [N: asymmetrical sectional shape] [N0409]
H01L21/288	. . . . .	from a liquid, e.g. electrolytic deposition
H01L21/288E	. . . . .	{7 dots} [N: using an external electrical current, i.e. electro-deposition] [N9809]
H01L21/30	. . . . .	Treatment of semiconductor bodies using processes or apparatus not provided for in groups H01L21/20 to H01L21/26 (manufacture of electrodes thereon H01L21/28) [C0202]
H01L21/30H	. . . . .	[N: Hydrogenation or deuterisation, e.g. using atomic hydrogen from a plasma]
H01L21/30H8	. . . . .	[N: of IIIIV compounds]
H01L21/302	. . . . .	to change their surface-physical characteristics or shape, e.g. etching, polishing, cutting
H01L21/304	. . . . .	Mechanical treatment, e.g. grinding, polishing, cutting [N: (H01L21/306P takes precedence)]
H01L21/304B	. . . . .	{7 dots} [N: Making grooves, e.g. cutting]
H01L21/304D	. . . . .	{7 dots} [N: using blasting, e.g. sand-blasting (H01L21/263B takes precedence)]
H01L21/306	. . . . .	Chemical or electrical treatment, e.g. electrolytic etching (to form insulating layers H01L21/31)
H01L21/306B	. . . . .	{7 dots} [N: Chemical etching]
H01L21/306B3	. . . . .	{8 dots} [N: Anisotropic liquid etching (H01L21/3063 takes precedence)] [C9511]
H01L21/306B4	. . . . .	{8 dots} [N: Etching of IIIIV compounds]
H01L21/306B4B	. . . . .	{9 dots} [N: Anisotropic liquid etching]
H01L21/306B4C	. . . . .	{9 dots} [N: Vapour phase etching]
H01L21/306P	. . . . .	{7 dots} [N: With simultaneous mechanical treatment, e.g. mechanico-chemical polishing]
H01L21/3063	. . . . .	{7 dots} Electrolytic etching [N9511]
H01L21/3063B	. . . . .	{8 dots} [N: of A three - B five compounds] [N9511]
H01L21/3065	. . . . .	{7 dots} Plasma etching; Reactive-ion etching [N9511]
H01L21/3065B	. . . . .	{8 dots} [N: comprising alternated and repeated etching and passivation steps, e.g. Bosch process] [N0411]
H01L21/308	. . . . .	{7 dots} using masks (H01L21/3063 , H01L21/3065 take precedence) [C9511]
H01L21/308B	. . . . .	{8 dots} [N: characterised by their composition, e.g. multilayer masks, materials]
H01L21/308D	. . . . .	{8 dots} [N: characterised by their size, orientation, disposition, behaviour, shape, in horizontal or vertical plane]
H01L21/308D2	. . . . .	{9 dots} [N: characterised by their behaviour during the process, e.g. soluble masks, redeposited masks]
H01L21/308D4	. . . . .	{9 dots} [N: characterised by the process involved to create the mask, e.g. lift-off masks, sidewalls, or to modify the mask, e.g. pre-treatment, post-treatment]
H01L21/308D6	. . . . .	{9 dots} [N: Process specially adapted to improve the resolution of the mask]
H01L21/31	. . . . .	to form insulating layers thereon, e.g. for masking or by using photolithographic techniques (layers forming electrodes H01L21/28 ; encapsulating layers H01L21/56); After treatment of these layers [C0711]

H01L21/3105	. . . . .	After-treatment
H01L21/3105B	. . . . .	{7 dots} [N: Planarisation of the insulating layers (H01L21/3105P takes precedence)] [C9708]
H01L21/3105B2	. . . . .	{8 dots} [N: involving a dielectric removal step] [N9511]
H01L21/3105B2B	. . . . .	{9 dots} [N: the removal being a chemical etching step, e.g. dry etching (etching per se H01L21/311)] [N9511]
H01L21/3105B2B2	. . . . .	{10 dots} [N: the removal being a selective chemical etching step, e.g. selective dry etching through a mask] [N9511]
H01L21/3105P	. . . . .	{7 dots} [N: of organic layers] [N9509]
H01L21/311	. . . . .	{7 dots} Etching the insulating layers [N: by chemical or physical means (H01L21/3105P takes precedence)] [C9511]
H01L21/311B	. . . . .	{8 dots} [N: Etching inorganic layers]
H01L21/311B2	. . . . .	{9 dots} [N: by chemical means]
H01L21/311B2B	. . . . .	{10 dots} [N: by dry-etching]
H01L21/311B2B2	. . . . .	{11 dots} [N: of layers not containing Si, e.g. PZT, Al ₂ O ₃] [N9807]
H01L21/311C	. . . . .	{8 dots} [N: Etching organic layers]
H01L21/311C2	. . . . .	{9 dots} [N: by chemical means]
H01L21/311C2B	. . . . .	{10 dots} [N: by dry-etching]
H01L21/311D	. . . . .	{8 dots} [N: using masks]
H01L21/3115	. . . . .	{7 dots} Doping the insulating layers [C0711]
H01L21/3115B	. . . . .	{8 dots} [N: by ion implantation]
H01L21/312	. . . . .	Organic layers, e.g. photoresist (H01L21/3105 , H01L21/32 take precedence; [N: photoresists per se G03C])
		[N: WARNING [N1104] This group and subgroups are no longer used for the classification of new documents as from Mai 1, 2011. The backlog of this group is being continuously reclassified to H01L21/02K2 and subgroups thereof]
H01L21/312B	. . . . .	{7 dots} [N: Layers comprising organo-silicon compounds]
H01L21/312B2	. . . . .	{8 dots} [N: layers comprising polysiloxane compounds] [N0006]
H01L21/312B2B	. . . . .	{9 dots} [N: layers comprising hydrogen silsesquioxane] [N0006]
H01L21/312B4	. . . . .	{8 dots} [N: layers comprising silazane compounds] [N0109]
H01L21/312F	. . . . .	{7 dots} [N: Layers comprising fluoro (hydro)carbon compounds, e.g. polytetrafluoroethylene] [N0006]
H01L21/312L	. . . . .	{7 dots} [N: by Langmuir-Blodgett techniques]
H01L21/314	. . . . .	Inorganic layers (H01L21/3105 , H01L21/32 take precedence)
		[N: WARNING [N1104] This group and subgroups are no longer used for the classification of new documents as from Mai 1, 2011. The backlog of this group is being continuously reclassified to H01L21/02K2 and subgroups thereof]
H01L21/314A	. . . . .	{7 dots} [N: Deposition using atomic layer deposition techniques]

		(ALD)] [N0409]
H01L21/314A2	. . . . .	{8 dots} [N: of nano-laminates, e.g. alternating layers of Al ₂ O ₃ -HfO ₂] [N0409]
H01L21/314B	. . . . .	{7 dots} [N: composed of alternated layers or of mixtures of nitrides and oxides or of oxinitrides, e.g. formation of oxinitride by oxidation of nitride layers]
H01L21/314B1	. . . . .	{8 dots} [N: on silicon] [N0205]
H01L21/314B2	. . . . .	{8 dots} [N: formed by deposition from a gas or vapour]
H01L21/314C	. . . . .	{7 dots} [N: Carbon layers, e.g. diamond-like layers] [N9609]
H01L21/314E	. . . . .	{7 dots} [N: Epitaxial deposition of insulating materials] [N0409]
H01L21/314H	. . . . .	{7 dots} [N: Silicon Carbide layers] [N0409]
H01L21/316	. . . . .	{7 dots} composed of oxides or glassy oxides or oxide based glass
		[N: WARNING [N1104] This group and subgroups are no longer used for the classification of new documents as from Mai 1, 2011. The backlog of this group is being continuously reclassified to H01L21/02K2 and subgroups thereof]
H01L21/316B	. . . . .	{8 dots} [N: Deposition from a gas or vapour (H01L21/316D , H01L21/316P take precedence)] [C9911]
H01L21/316B2	. . . . .	{9 dots} [N: Deposition of SiO ₂ (H01L21/316B4 , H01L21/316B6 and H01L21/316B8 take precedence)] [C0409]
H01L21/316B2B	. . . . .	{10 dots} [N: on a silicon body]
H01L21/316B3	. . . . .	{9 dots} [N: Deposition of Al ₂ O ₃]
H01L21/316B3B	. . . . .	{10 dots} [N: on a silicon body]
H01L21/316B4	. . . . .	{9 dots} [N: Deposition of boron or phosphorus doped silicon oxide, e.g. BSG, PSG, BPSG] [N9911]
H01L21/316B6	. . . . .	{9 dots} [N: Deposition of halogen doped silicon oxide, e.g. fluorine doped silicon oxide] [N9911]
H01L21/316B8	. . . . .	{9 dots} [N: Deposition of carbon doped silicon oxide, e.g. SiOC] [N0109]
H01L21/316B10	. . . . .	{9 dots} [N: Deposition of Tantalum oxides, e.g. Ta ₂ O ₅] [N0409]
H01L21/316B12	. . . . .	{9 dots} [N: Deposition of Zirconium oxides, e.g. ZrO ₂] [N0409]
H01L21/316B14	. . . . .	{9 dots} [N: Deposition of Hafnium oxides, e.g. HfO ₂] [N0409]
H01L21/316C	. . . . .	{8 dots} [N: formed by oxidation (H01L21/316D , H01L21/316P take precedence)] [C9911]
H01L21/316C2	. . . . .	{9 dots} [N: of semiconductor materials, e.g. the body itself]
H01L21/316C2B	. . . . .	{10 dots} [N: by thermal oxidation, e.g. of SiGe] [C0309]
H01L21/316C2B2	. . . . .	{11 dots} [N: of silicon in uncombined form] [C0309]
H01L21/316C2B3	. . . . .	{11 dots} [N: of AIII BV compounds]
H01L21/316C2C	. . . . .	{10 dots} [N: of anodic oxidation]
H01L21/316C2C2	. . . . .	{11 dots} [N: of silicon]
H01L21/316C2C3	. . . . .	{11 dots} [N: of AIII BV compounds]

H01L21/316C3	. . . . .	{9 dots} [N: of metallic layers, e.g. Al deposited on the body, e.g. formation of multi-layer insulating structures]
H01L21/316C3B	. . . . .	{10 dots} [N: by anodic oxidation]
H01L21/316D	. . . . .	{8 dots} [N: with perovskite structure] [N9703] [C9911]
H01L21/316P	. . . . .	{8 dots} [N: Deposition of porous oxides or porous glassy oxides or oxide based porous glass] [N9911]
H01L21/318	. . . . .	{7 dots} composed of nitrides
		[N: WARNING [N1104] This group and subgroups are no longer used for the classification of new documents as from Mai 1, 2011. The backlog of this group is being continuously reclassified to H01L21/02K2 and subgroups thereof]
H01L21/318B	. . . . .	{8 dots} [N: of siliconnitrides]
H01L21/32	. . . . .	using masks
H01L21/3205	. . . . .	Deposition of non-insulating-, e.g. conductive- or resistive-, layers on insulating layers; After-treatment of these layers (manufacture of electrodes H01L21/28)
H01L21/3205M	. . . . .	{7 dots} [N: Deposition of metallic or metal-silicide layers]
H01L21/3205M2	. . . . .	{8 dots} [N: of metal-silicide layers] [N9410]
H01L21/3205N	. . . . .	{7 dots} [N: Deposition of semiconductive layers, e.g. poly - or amorphous silicon layers]
H01L21/3205P	. . . . .	{7 dots} [N: Deposition of conductive or semi-conductive organic layers (H01L21/3205Q takes precedence)]
H01L21/3205Q	. . . . .	{7 dots} [N: Deposition of supra-conductive layers]
H01L21/321	. . . . .	{7 dots} After treatment
H01L21/321C	. . . . .	{8 dots} [N: Oxidation of silicon-containing layers] [C0503]
H01L21/321D	. . . . .	{8 dots} [N: Nitridation of silicon-containing layers] [C0505]
H01L21/321P	. . . . .	{8 dots} [N: Planarisation] [N9708] [N0711]
H01L21/321P2	. . . . .	{9 dots} [N: by chemical mechanical polishing (CMP)] [N9708]
H01L21/321P2B	. . . . .	{10 dots} [N: by simultaneously passing an electrical current, i.e. electrochemical mechanical polishing, e.g. ECMP [N0409]]
H01L21/3213	. . . . .	{8 dots} Physical or chemical etching of the layers, e.g. to produce a patterned layer from a pre-deposited extensive layer [N9804]
H01L21/3213B	. . . . .	{9 dots} [N: by physical means only] [N9804]
H01L21/3213B2	. . . . .	{10 dots} [N: of silicon-containing layers] [N9804]
H01L21/3213C	. . . . .	{9 dots} [N: by chemical means only] [N9804]
H01L21/3213C2	. . . . .	{10 dots} [N: by liquid etching only] [N9804]
H01L21/3213C4	. . . . .	{10 dots} [N: by vapour etching only] [N9804]
H01L21/3213C4B	. . . . .	{11 dots} [N: using plasmas] [N9804]
H01L21/3213C4B2	. . . . .	{12 dots} [N: of silicon-containing layers] [N9804]
H01L21/3213C4D	. . . . .	{11 dots} [N: pre- or post-treatments, e.g. anti-corrosion processes] [N9804]
H01L21/3213D	. . . . .	{9 dots} [N: using masks] [N9804]

- H01L21/3215 {8 dots} Doping the layers
- H01L21/3215B {9 dots} [N: Doping polycrystalline - or amorphous silicon layers]
- H01L21/322 to modify their internal properties, e.g. to produce internal imperfections
- H01L21/322B [N: of silicon bodies, e.g. for gettering] [C0101]
- H01L21/322B2 {7 dots} [N: using cavities formed by hydrogen or noble gas ion implantation] [N0109]
- H01L21/322B8 {7 dots} [N: Thermally inducing defects using oxygen present in the silicon body for intrinsic gettering ([H01L21/322B10](#) takes precedence)] [C0101]
- [N: **Note**
Gettering using both extrinsic and intrinsic gettering techniques is classified in both [H01L21/322B](#) and [H01L21/322B8](#)]
- H01L21/322B10 {7 dots} [N: of silicon on insulator] [N0101]
- H01L21/322C [N: of IIIIV compounds, e.g. to make them semi-insulating] [C9509]
- H01L21/324 Thermal treatment for modifying the properties of semiconductor bodies, e.g. annealing, sintering ([H01L21/20](#) to [H01L21/288](#) and [H01L21/302](#) to [H01L21/322](#) take precedence)
- H01L21/324B [N: for the formation of PN junctions without addition of impurities ([H01L21/22](#) takes precedence)]
- H01L21/324P [N: of III-V compounds]
- H01L21/324S [N: for altering the shape, e.g. smoothing the surface] [N: Warning: Not complete, see provisionally also [H01L21/324](#)] [N1204]
- H01L21/326 Application of electric currents or fields, e.g. for electroforming ([H01L21/20](#) to [H01L21/288](#) and [H01L21/302](#) to [H01L21/324](#) take precedence)
- H01L21/34 the devices having semiconductor bodies not provided for in groups [N: [H01L21/04D](#), [H01L21/04H](#)], [H01L21/06](#), [H01L21/16](#) and [H01L21/18](#) with or without impurities, e.g. doping materials [C9907]
- H01L21/36 Deposition of semiconductor materials on a substrate, e.g. epitaxial growth
- [N: **WARNING** [N0911]
This group is no longer used for the classification of new documents as from December 1, 2009. The backlog of this group is being continuously reclassified to [H01L21/02K4](#) and subgroups]
- H01L21/363 using physical deposition, e.g. vacuum deposition, sputtering
- H01L21/365 using reduction or decomposition of a gaseous compound yielding a solid condensate, i.e. chemical deposition
- H01L21/368 using liquid deposition
- H01L21/38 Diffusion of impurity materials, e.g. doping materials, electrode materials, into or out of a semiconductor body, or between semiconductor regions
- H01L21/383 using diffusion into or out of a solid from or into a gaseous phase
- H01L21/385 using diffusion into or out of a solid from or into a solid phase, e.g. a doped oxide layer
- H01L21/388 using diffusion into or out of a solid from or into a liquid phase, e.g. alloy diffusion processes
- H01L21/40 Alloying of impurity materials, e.g. doping materials, electrode materials, with

		a semiconductor body
H01L21/42	. . . .	Bombardment with radiation
H01L21/423	. . . . .	with high-energy radiation
H01L21/425	. . . . .	producing ion implantation (ion beam tubes for localized treatment H01J37/30)
H01L21/426	. . . . .	{7 dots} using masks
H01L21/428	. . . . .	using electromagnetic radiation, e.g. laser radiation
H01L21/44	. . . .	Manufacture of electrodes on semiconductor bodies using processes or apparatus not provided for in groups H01L21/36 to H01L21/428
H01L21/441	. . . . .	Deposition of conductive or insulating materials for electrodes
H01L21/443	. . . . .	from a gas or vapour, e.g. condensation
H01L21/445	. . . . .	from a liquid, e.g. electrolytic deposition
H01L21/447	. . . . .	involving the application of pressure, e.g. thermo-compression bonding [C1204]
H01L21/449	. . . . .	involving the application of mechanical vibrations, e.g. ultrasonic vibrations
H01L21/46	. . . .	Treatment of semiconductor bodies using processes or apparatus not provided for in groups H01L21/428 (manufacture of electrodes thereon H01L21/44)
H01L21/461	. . . . .	to change their surface-physical characteristics or shape, e.g. etching, polishing, cutting
H01L21/463	. . . . .	Mechanical treatment, e.g. grinding, ultrasonic treatment
H01L21/465	. . . . .	Chemical or electrical treatment, e.g. electrolytic etching (to form insulating layers H01L21/469)
H01L21/467	. . . . .	{7 dots} using masks
H01L21/469	. . . . .	to form insulating layers thereon, e.g. for masking or by using photolithographic techniques (layers forming electrodes H01L21/44 ; encapsulating layers H01L21/56); After-treatment of these layers
H01L21/47	. . . . .	{7 dots} organic layers, e.g. photoresist (H01L21/475 , H01L21/4757 take precedence)
H01L21/471	. . . . .	{7 dots} Inorganic layers (H01L21/475 , H01L21/4757 take precedence)
H01L21/473	. . . . .	{8 dots} composed of oxides or glassy oxides or oxide based glass
H01L21/475	. . . . .	{7 dots} using masks
H01L21/4757	. . . . .	{7 dots} After-treatment
H01L21/4757B	. . . . .	{8 dots} [N: Etching the layer]
H01L21/4757C	. . . . .	{8 dots} [N: Doping the layer]
H01L21/4763	. . . . .	Deposition of non-insulating, e.g. conductive -, resistive -, layers on insulating layers; After-treatment of these layers (manufacture of electrodes H01L21/28 , [N: H01L21/44])
H01L21/4763B	. . . . .	{7 dots} [N: After-treatment of these layers]
H01L21/477	. . . . .	Thermal treatment for modifying the properties of semiconductor bodies, e.g. annealing, sintering (H01L21/36 to H01L21/449 and H01L21/461 to H01L21/475 take precedence)
H01L21/479	. . . . .	Application of electric currents or fields, e.g. for electroforming (H01L21/36 to H01L21/449 and H01L21/461 to H01L21/477 take precedence)

- H01L21/48 Manufacture or treatment of parts, e.g. containers, prior to assembly of the devices, using processes not provided for in a single one of the subgroups [H01L21/06](#) to [H01L21/326](#) ([N: apparatus therefor [H01L21/67S](#); insulative sealing of leads in bases [H01L21/50](#)]; containers, encapsulations, fillings, mountings per se [H01L23/00](#); [N: marking of parts [H01L23/544](#)]) [C0506] [M1205]
- [N: **Note**
In this group, the expression "treatment" covers also the removal of leads from parts
]
- H01L21/48B [N: Insulating or insulated parts, e.g. mountings, containers, diamond heatsinks ([H01L21/48C4](#) takes precedence; printed circuit boards [H05K1/00](#))]
- H01L21/48B2 [N: Ceramic parts]
- H01L21/48B3 [N: Insulating layers on insulating parts, with or without metallisation]
- H01L21/48C [N: Conductive parts]
- H01L21/48C2 [N: for containers, e.g. caps ([H01L21/48C5](#) takes precedence)]
- H01L21/48C3 [N: Flat leads, e.g. lead frames with or without insulating supports]
- H01L21/48C3C [N: Connection or disconnection of other leads to or from flat leads, e.g. wires, bumps, other flat leads]
- H01L21/48C3E [N: Etching (etching for cleaning without patterning [H01L21/48C3H](#))] [N0506]
- H01L21/48C3E4 {7 dots} [N: Etching a temporary substrate after encapsulation process to form leads] [N0506]
- H01L21/48C3H [N: Cleaning, e.g. removing of solder]
- H01L21/48C3L [N: Assembly of a flat lead with an insulating support, e.g. for TAB]
- H01L21/48C3M [N: Mechanical treatment, e.g. punching, cutting, deforming, cold welding]
- H01L21/48C4 [N: Leads on or in insulating or insulated substrates, e.g. metallisation ([H01L21/48C3](#) takes precedence; metallisation of ceramics in general [C04B41/51](#); printed circuits [H05K3/00](#))]
- H01L21/48C4B [N: Adaptation of interconnections, e.g. engineering charges, repair techniques]
- H01L21/48C4C [N: Connection or disconnection of other leads to or from a metallisation, e.g. pins, wires, bumps]
- H01L21/48C4D [N: Multilayer substrates (multilayer metallisation on monolayer substrate [H01L21/48C4](#))]
- H01L21/48C4E [N: Via connections through the substrate with or without pins]
- H01L21/48C4H [N: Cleaning, e.g. removing of solder]
- H01L21/48C4S [N: Applying pastes or inks, e.g. screen printing ([H01L21/48C4E](#) takes precedence)]
- H01L21/48C5 [N: Bases, plates or heatsinks]
- H01L21/48C5C [N: Connection or disconnection of other leads to or from bases or plates]
- H01L21/48C5M [N: Mechanical treatment, e.g. deforming]
- H01L21/48C5P [N: Assembly of heatsink parts]
- H01L21/48C7 [N: Wire-like parts or pins (wire ball formation [B23K20/00](#); methods related to connecting semiconductor or other solid state bodies [H01L24/00](#))] [C1108]

[N: WARNING [N1006]

The documents of this group and subgroups dealing with methods for connecting semiconductor or other solid state bodies are being continuously reclassified to [H01L24/43](#)

]

- H01L21/48C7C [N: Connection or disconnection of other leads to or from wire-like parts, e.g. wires]
- H01L21/48C7H [N: Cleaning]
- H01L21/48C7M [N: Mechanical treatment, e.g. cutting, bending]
- H01L21/50 Assembly of semiconductor devices using processes or apparatus not provided for in a single one of the subgroups [H01L21/06](#) to [H01L21/326](#), [N: e.g. sealing of a cap to a base of a container]

[N: Notes [N1006]

Arrangements for connecting or disconnecting semiconductor or other solid state bodies, or methods related thereto, other than those arrangements or methods covered by the following subgroups, are covered by [H01L24/00](#)

]

- H01L21/52 Mounting semiconductor bodies in containers
- H01L21/54 Providing fillings in containers, e.g. gas fillings
- H01L21/56 Encapsulations, e.g. encapsulation layers, coatings
- H01L21/56B [N: Batch processing] [N0612]
- H01L21/56F [N: Encapsulation of active face of flip-chip device, e.g. underfilling or underencapsulation of flip-chip, encapsulation preform on chip or mounting substrate] [N9601]
- H01L21/56M [N: Moulds]
- H01L21/56M4 [N: Release layers for moulds, e.g. release layers, layers against residue during moulding] [N0506]
- H01L21/56T [N: Temporary substrate used as encapsulation process aid (H01L21/48C3E4 and H01L21/56M4 take precedence)] [N0612]
- H01L21/58 [N: Insulative] mounting semiconductor devices on supports [N: ([H01L21/56F](#), [H01L23/495A6](#) take precedence)] [C9601]

[N: WARNING [N1006]

This group is no longer used for the classification of new documents as from June 1, 2010. The backlog of this group is being continuously reclassified to [H01L24/80](#) and subgroups

]

- H01L21/62 the devices having no potential-jump barriers or surface barriers
- H01L21/64 Manufacture or treatment of solid state devices other than semiconductor devices, or of parts thereof, not peculiar to a single device provided for in groups [H01L31/00](#) to [H01L51/00](#) [C9907]
- H01L21/67 Apparatus specially adapted for handling semiconductor or electric solid state devices during manufacture or treatment thereof; Apparatus specially adapted for handling wafers during manufacture or treatment of semiconductor or electric solid state devices or components; [N: Apparatus not specifically provided for elsewhere (processes per se [H01L21/30](#), [H01L21/46](#), [H01L23/00](#); simple temporary support means, e.g. using adhesives, electric or magnetic means [H01L21/68](#), [H01L21/302](#); apparatus for manufacturing arrangements for connecting or disconnecting semiconductor or solid-state bodies and for methods related thereto [H01L24/74](#);)] [N0403] [C1207]

[N: Notes [N1108]

In this subgroup the term substrate designates a semiconductor or electric solid state device or component, or a wafer

]

- H01L21/67S [N: Apparatus not specifically provided for elsewhere (processes per se [H01L21/30](#), [H01L21/46](#), [H01L23/00](#); simple temporary support means, e.g. using adhesives, electric or magnetic means [H01L21/68](#), [H01L21/302](#))] [N1108]
- H01L21/67S2 [N: Apparatus for manufacture or treatment (processes [H01L21/30](#), [H01L21/46](#); for production or after-treatment of single crystals or homogeneous polycrystalline material [C30B35/00](#))] [N1108]
- H01L21/67S2D [N: Apparatus for fluid treatment ([H01L21/67S2M](#), [H01L21/67S2V](#) take precedence)] [N1108]
- H01L21/67S2D2 [N: for general liquid treatment, e.g. etching followed by cleaning] [N1108]
- H01L21/67S2D4 [N: for cleaning followed by drying, rinsing, stripping, blasting or the like] [N1108]
- H01L21/67S2D4D [N: for drying] [N1108]
- H01L21/67S2D4W [N: for wet cleaning or washing] [N1108]
- H01L21/67S2D4W2 {7 dots} [N: using mainly scrubbing means, e.g. brushes] [N1108]
- H01L21/67S2D4W4 {7 dots} [N: using mainly spraying means, e.g. nozzles] [N1108]
- H01L21/67S2D4W6 {7 dots} [N: with the semiconductor substrates being dipped in baths or vessels] [N1108]
- H01L21/67S2D8 [N: for etching] [N1108]
- H01L21/67S2D8D [N: for drying etching] [N1108]
- H01L21/67S2D8W [N: for wet etching] [N1108]
- H01L21/67S2D8W4 {7 dots} [N: using mainly spraying means, e.g. nozzles] [N1108]
- H01L21/67S2D8W6 {7 dots} [N: with the semiconductor substrates being dipped in baths or vessels] [N1108]
- H01L21/67S2F [N: Apparatus for mechanical treatment (or grinding or cutting, see the relevant groups in subclasses B24B or B28D)] [N1108]
- H01L21/67S2H [N: Apparatus for thermal treatment] [N1108]
- H01L21/67S2H2 [N: mainly by conduction] [N1108]
- H01L21/67S2H4 [N: mainly by convection] [N1108]
- H01L21/67S2H6 [N: mainly by radiation] [N1108]
- H01L21/67S2K [N: Apparatus for making assemblies not otherwise provided for, e.g. package constructions] [N1108]
- H01L21/67S2M [N: Apparatus for sealing, encapsulating, glassing, decapsulating or the like (processes [H01L23/02](#), [H01L23/28](#))] [N1108]
- H01L21/67S2P [N: Apparatus for placing on an insulating substrate, e.g. tape] [N1108]
- H01L21/67S2R [N: Apparatus for wiring semiconductor or solid state device] [N1108]
- H01L21/67S2T [N: Apparatus for mounting on conductive members, e.g. leadframes or conductors on insulating substrates] [N1108]
- H01L21/67S2V [N: Apparatus for applying a liquid, a resin, an ink or the like ([H01L21/67S2M](#) takes precedence)] [N1108]
- H01L21/67S2Z [N: Apparatus for manufacturing or treating in a plurality of work-stations] [N1108]
- H01L21/67S2Z2 [N: characterized by the layout of the process chambers] [N1108]

H01L21/67S2Z2C	. . . . .	[N: surrounding a central transfer chamber] [N1108]
H01L21/67S2Z2L	. . . . .	[N: in-line arrangement] [N1108]
H01L21/67S2Z2V	. . . . .	[N: vertical arrangement] [N1108]
H01L21/67S2Z4	. . . . .	[N: characterized by the presence of more than one transfer chamber] [N1108]
H01L21/67S2Z6	. . . . .	[N: characterized by the construction of the processing chambers, e.g. modular processing chambers] [N1108]
H01L21/67S2Z8	. . . . .	[N: characterized by the construction of the transfer chamber] [N1108]
H01L21/67S2Z9	. . . . .	[N: characterized by the construction of the load-lock chamber] [N1108]
H01L21/67S2Z10	. . . . .	[N: comprising a chamber adapted to a particular process] [N1108]
H01L21/67S2Z10B	. . . . .	[N: comprising at least one ion or electron beam chamber (coating by ion implantation C23C; ion or electron beam tubes H01J37/00)] [N1108]
H01L21/67S2Z10C	. . . . .	[N: comprising at least one polishing chamber (polishing apparatuses B24B)] [N1108]
H01L21/67S2Z10L	. . . . .	[N: comprising at least one lithography chamber (lithographic apparatuses G03F7/00)] [N1108]
H01L21/67S2Z10P	. . . . .	[N: comprising at least one plating chamber (electroless plating apparatuses C23C, electroplating apparatuses C25D)] [N1108]
H01L21/67S2Z12	. . . . .	[N: the substrates being processed being not semiconductor wafers, e.g. leadframes or chips] [N1108]
H01L21/67S8	. . . . .	[N: Apparatus for monitoring, sorting or marking (testing or measuring during manufacture H01L22/00 , marks per se H01L23/544 ; testing individual semiconductor devices G01R31/26)] [N1108] [C1205]
H01L21/67S8A	. . . . .	[N: Temperature monitoring] [N1108]
H01L21/67S8B	. . . . .	[N: Process monitoring, e.g. flow or thickness monitoring] [N1108]
H01L21/67S8C	. . . . .	[N: Position monitoring, e.g. misposition detection or presence detection] [N1108]
H01L21/67S8C2	. . . . .	[N: of substrates stored in a container, a magazine, a carrier, a boat or the like] [N1108]
H01L21/67S8D	. . . . .	[N: Sorting devices] [N1108]
H01L21/67S8E	. . . . .	[N: Production flow monitoring, e.g. for increasing throughput (program-control systems per se G05B19/00 , e.g. total factory control G05B19/418)] [N1108]
H01L21/67S8F	. . . . .	[N: Marking devices] [N1108]
H01L21/67S8G	. . . . .	[N: Monitoring of warpage, curvature, damage, defects or the like] [N1108]
H01L21/67S8H	. . . . .	[N: using identification means, e.g. labels on substrates or labels on containers] [N1108]
H01L21/673	. . . . .	using specially adapted carriers [N: or holders; Fixing the workpieces on such carriers or holders (holders for supporting a complete device in operation H01L23/32)] [N0405]
H01L21/673A	. . . . .	[N: Vertical boat type carrier whereby the substrates are horizontally supported, e.g. comprising rod-shaped elements] [N0809]
H01L21/673A1	. . . . .	[N: characterized by a material, a roughness, a coating or the like] [N0809]
H01L21/673A2	. . . . .	[N: characterized by the substrate support] [N0809]
H01L21/673B	. . . . .	[N: Horizontal boat type carrier whereby the substrates are vertically supported, e.g. comprising rod-shaped elements] [N0809]
H01L21/673B1	. . . . .	[N: characterized by a material, a roughness, a coating or the like] [N0809]

- H01L21/673C . . . [N: Vertical carrier comprising wall type elements whereby the substrates are horizontally supported, e.g. comprising sidewalls] [N0809]
- H01L21/673C1 [N: characterized by a material, a roughness, a coating or the like] [N0809]
- H01L21/673D . . . [N: Horizontal carrier comprising wall type elements whereby the substrates are vertically supported, e.g. comprising sidewalls] [N0809]
- H01L21/673D1 [N: characterized by a material, a roughness, a coating or the like] [N0809]
- H01L21/673E . . . [N: Trays for chips (**magazine for components [H05K13/00P](#)**)] [N0809]
- H01L21/673E1 [N: characterized by a material, a roughness, a coating or the like] [N0809]
- H01L21/673F . . . [N: specially adapted for supporting large square shaped substrates (**containers and packaging elements for glass sheets [B65D85/48](#), transporting of glass products during their manufacture [C03B35/00](#)**)] [N0809]
- H01L21/673F1 [N: characterized by a material, a roughness, a coating or the like] [N0809]
- H01L21/673G . . . [N: characterized by being specially adapted for supporting a single substrate or by comprising a stack of such individual supports] [N0809]
- H01L21/673K . . . [N: Closed carriers] [N0405]
- H01L21/673K1 [N: specially adapted for a single substrate] [N0911]
- H01L21/673K2 [N: specially adapted for containing chips, dies or ICs] [N0911]
- H01L21/673K3 [N: specially adapted for containing masks, reticles or pellicles] [N0911]
- H01L21/673K4 [N: specially adapted for containing substrates other than wafers (**[H01L21/673K2](#), [H01L21/673K3](#) take precedence**)] [N0911]
- H01L21/673K5 [N: characterised by materials, roughness, coatings or the like (**materials relating to an injection moulding process [B29C45/00](#); chemical composition of materials [C08L51/00](#)**)] [N0911]
- H01L21/673K6 [N: characterised by shock absorbing elements, e.g. retainers or cushions] [N0911]
- H01L21/673K7 [N: characterised by locking systems] [N0911]
- H01L21/673K8 [N: characterised by sealing arrangements] [N0911]
- H01L21/673K9 [N: characterised by coupling elements, kinematic members, handles or elements to be externally gripped] [N0911]
- H01L21/673K10 [N: characterised by substrate supports] [N0911]
- H01L21/673K11 [N: characterised by the construction of the closed carrier] [N0911]
- H01L21/673K12 [N: characterised by atmosphere control] [N0911]
- H01L21/673K12A [N: characterised by the presence of atmosphere modifying elements inside or attached to the closed carrier] [N0911]
- H01L21/673K13 [N: characterised by the presence of antistatic elements] [N0911]
- H01L21/677 . . for conveying, e.g. between different workstations [N0405]
- H01L21/677A . . . [N: between different workstations] [N1107]
- [N: **WARNING** [N1107]
This group and subgroups are not complete pending completion of reorganization; see also [H01L21/677](#)
]
- H01L21/677A1 [N: Mechanical details, e.g. roller, belt (**[H01L21/677A2](#) takes precedence**)] [N1107]
- H01L21/677A2 [N: using magnetic elements] [N1107]
- H01L21/677A3 [N: the substrate being handled substantially vertically] [N1107]
- H01L21/677A4 [N: Changing the direction of the conveying path] [N1107]

- H01L21/677A5 [N: Changing orientation of the substrate, e.g. from a horizontal position to a vertical position] [N1107]
- H01L21/677A6 [N: the substrates to be conveyed not being semiconductor wafers or large planar substrates, e.g. chips, lead frames, [H01L21/677A9](#) takes precedence] [N1107]
- H01L21/677A7 [N: by means of a cart or a vehicle] [N1107]
- H01L21/677A8 [N: using a general scheme of a conveying path within a factory] [N1107]
- H01L21/677A9 [N: Conveying cassettes, containers or carriers] [N1107]
- H01L21/677A10 [N: Overhead conveying] [N1107]
- H01L21/677A11 [N: Loading to or unloading from a conveyor] [N1107]
- H01L21/677B [N: into and out of processing chamber] [N0405] [C0605]
- H01L21/677B2 [N: Mechanical parts of transfer devices (robots in general in B25J)] [N0601]
- H01L21/677B4 [N: characterized by movements or sequence of movements of transfer devices] [N0601]
- H01L21/677B6 [N: horizontal transfer of a single workpiece] [N0601]
- H01L21/677B8 [N: vertical transfer of a single workpiece] [N0601]
- H01L21/677B10 [N: horizontal transfer of a batch of workpieces] [N0601]
- H01L21/677B12 [N: vertical transfer of a batch of workpieces] [N0601]
- H01L21/677B14 [N: Continuous loading and unloading into and out of a processing chamber, e.g. transporting belts within processing chambers] [N1107]

- [N: **WARNING** [N1107]
Not complete pending completion of reorganization; see also [H01L21/677](#)
]
- H01L21/677D [N: the wafers being stored in a carrier, involving loading and unloading ([H01L21/677F8](#) takes precedence)] [N0405]
- H01L21/677D2 [N: Mechanical parts of transfer devices (robots in general in [B25J](#))] [N0405]
- H01L21/677D4 [N: Storage means] [N0405]
- H01L21/677D6 [N: involving removal of lid, door, cover] [N0405]
- H01L21/677D8 [N: Docking arrangements] [N0405]
- H01L21/677D10 [N: involving loading and unloading of wafers] [N0405]
- H01L21/677D10B [N: Batch transfer of wafers] [N0405]
- H01L21/677F [N: using air tracks] [N0405]
- H01L21/677F4 [N: with angular orientation of the workpieces] [N0405]
- H01L21/677F8 [N: the workpieces being stored in a carrier, involving loading and unloading] [N0405]
- H01L21/677H [N: with orientating and positioning by means of a vibratory bowl or track] [N0405]
- H01L21/677K [N: with angular orientation of workpieces ([H01L21/677F4](#) and [H01L21/677H](#) take precedence)] [N0405]
- H01L21/68 for positioning, orientation or alignment (for conveying [H01L21/677](#)) [C0405]

- [N: **Warning**
This group is in reorganisation. See provisionally also group [H01L21/68T](#)
]
- H01L21/68L [N: using optical controlling means] [N0405]
- H01L21/68M [N: Mask-wafer alignment (in general [G03F7/20T](#), [G03F9/00T](#))] [N0405]

- H01L21/683 . . . for supporting or gripping (for conveying [H01L21/677](#), for positioning, orientation or alignment [H01L21/68](#)) [N0405]
- H01L21/683C . . . [N: using electrostatic chucks] [N0405]
- H01L21/683C2 [N: Details of electrostatic chucks] [N0405]
- H01L21/683T [N: using temporarily an auxiliary support] [N0405]
- [N: **Notes**
[N1207]When classifying in group [H01L21/683T](#), details of the apparatus are to be further indexed using the ICO codes chosen from [T01L221/683T](#) and subgroups
]
- H01L21/683T2 [N: Wafer tapes, e.g. grinding or dicing support tapes (adhesive tapes in general [C09J7/02](#))] [N1108]
- H01L21/683V [N: with gripping and holding devices using a vacuum; Bernoulli devices] [N0405]
- H01L21/687 using mechanical means, e.g. chucks, clamps or pinches [N: (using electrostatic chucks [H01L21/683C](#))] [N0405]
- H01L21/687G [N: the wafers being placed on a robot blade, or gripped by a gripper for conveyance] [N0405]
- H01L21/687S [N: the wafers being placed on a susceptor, stage or support] [N0405]
- H01L21/687S2 [N: characterised by edge clamping, e.g. clamping ring] [N0711]
- H01L21/687S4 [N: characterised by a plurality of separate clamping members, e.g. clamping fingers] [N0711]
- H01L21/687S6 [N: characterised by edge profile or support profile] [N0711]
- H01L21/687S8 [N: characterised by a lifting arrangement, e.g. lift pins] [N0711]
- H01L21/687S10 [N: characterised by a plurality of individual support members, e.g. support posts or protrusions] [N0711]
- H01L21/687S12 [N: characterised by a coating or a hardness or a material] [N0711]
- H01L21/687S14 [N: characterised by a movable susceptor, stage or support, others than those only rotating on their own vertical axis, e.g. susceptors on a rotating carousel] [N0711]
- H01L21/687S16 [N: characterised by supporting more than one semiconductor substrate] [N0711]
- H01L21/687S18 [N: characterised by supporting substrates others than wafers, e.g. chips] [N0711]
- H01L21/687S20 [N: characterised by the mechanical construction of the susceptor, stage or support] [N0711]
- H01L21/687S22 [N: characterised by the construction of the shaft] [N0711]
- H01L21/70 Manufacture or treatment of devices consisting of a plurality of solid state components formed in or on a common substrate or of parts thereof ; Manufacture of integrated circuit devices or of parts thereof ([N: multistep manufacturing processes of assemblies consisting of a plurality of individual semiconductor or other solid state devices [H01L25/00](#)], manufacture of assemblies consisting of preformed electrical components [H05K3/00](#), [H05K13/00](#)) [C1204]
- H01L21/70B [N: of thick-or thin-film circuits or parts thereof]
- H01L21/70B2 [N: of thick-film circuits or parts thereof]
- H01L21/70B3 [N: of thin-film circuits or parts thereof]
- H01L21/71 Manufacture of specific parts of devices defined in group [H01L21/70](#) ([N: [H01L21/04D](#), [H01L21/04H](#)], [H01L21/28](#), [H01L21/44](#), [H01L21/48](#) take precedence)

			[N9504] [C9907]
H01L21/74	. . .	Making of [N: localized] buried regions, e.g. buried collector layers, internal connections [N: substrate contacts] [C9504]	
H01L21/74B	. . . .	[N: Making of internal connections, substrate contacts] [C9504]
H01L21/74F	. . . .	[N: for AIII-BV integrated circuits]
H01L21/76	. . .	Making of isolation regions between components [C9504]	
H01L21/76H	. . . .	[N: between components manufactured in an active substrate comprising SiC compounds] [N9511]
H01L21/76P	. . . .	[N: between components manufactured in an active substrate comprising AIII BV compounds]
H01L21/76R	. . . .	[N: between components manufactured in an active substrate comprising II-VI compounds] [N9511]
H01L21/761	. . . .	PN junctions [N9504] [C0404]
H01L21/762	. . . .	Dielectric regions, [N: e.g. EPIC dielectric isolation, LOCOS; Trench refilling techniques, SOI technology, use of channel stoppers] [N9504] [C0404]
H01L21/762B	. . . . .	[N: using a local oxidation of silicon, e.g. LOCOS, SWAMI, SILO (H01L21/762C6A takes precedence; together with vertical isolation, e.g. LOCOS in a SOI substrate, H01L21/762D20)] [N9504] [C0011]
H01L21/762B2	. . . . .	[N: in a region being recessed from the surface, e.g. in a recess, groove, tub or trench region] [N0011]
H01L21/762B2B	. . . . .	{7 dots} [N: using auxiliary pillars in the recessed region, e.g. to form LOCOS over extended areas] [N0011]
H01L21/762B2C	. . . . .	{7 dots} [N: the recessed region having a shape other than rectangular, e.g. rounded or oblique shape (H01L21/762B2B takes precedence)] [N0011]
H01L21/762B4	. . . . .	[N: introducing electrical inactive or active impurities in the local oxidation region, e.g. to alter LOCOS oxide growth characteristics or for additional isolation purpose] [N0011]
H01L21/762B4B	. . . . .	{7 dots} [N: introducing electrical active impurities in the local oxidation region for the sole purpose of creating channel stoppers] [N0011]
H01L21/762B4B2	. . . . .	{8 dots} [N: introducing both types of electrical active impurities in the local oxidation region for the sole purpose of creating channel stoppers, e.g. for isolation of complementary doped regions] [N0011]
H01L21/762B6	. . . . .	[N: with a plurality of successive local oxidation steps] [N0011]
H01L21/762C	. . . . .	[N: using trench refilling with dielectric materials (trench filling with polycrystalline silicon H01L21/763 ; together with vertical isolation, e.g. trench refilling in a SOI substrate H01L21/762D20)] [N9504] [C0011]
H01L21/762C2	. . . . .	[N: the dielectric materials being obtained by full chemical transformation of non-dielectric materials, such as polycrystalline silicon, metals] [N9504]
H01L21/762C4	. . . . .	[N: Concurrent filling of a plurality of trenches having a different trench shape or dimension, e.g. rectangular and V-shaped trenches, wide and narrow trenches, shallow and deep trenches] [N0011]
H01L21/762C6	. . . . .	[N: of trenches having a shape other than rectangular or V-shape, e.g. rounded corners, oblique or rounded trench walls (H01L21/762C4 takes precedence)] [N0011]
H01L21/762C6A	. . . . .	{7 dots} [N: trench shape altered by a local oxidation of silicon process step, e.g. trench corner rounding by LOCOS] [N0011]

H01L21/762C8	. . . . .	[N: introducing impurities in trench side or bottom walls, e.g. for forming channel stoppers or alter isolation behavior] [N0011]
H01L21/762D	. . . . .	[N: using semiconductor on insulator (SOI) technology (H01L21/762F takes precedence; manufacture of integrated circuits on insulating substrates H01L21/84 ; silicon on sapphire (SOS) technology H01L21/86)] [N9504] [C0101]
H01L21/762D2	. . . . .	[N: using silicon implanted buried insulating layers, e.g. oxide layers, i.e. SIMOX techniques] [N9504]
H01L21/762D4	. . . . .	[N: using full isolation by porous oxide silicon, i.e. FIPOS techniques] [N9504]
H01L21/762D6	. . . . .	[N: using lateral overgrowth techniques, i.e. ELO techniques] [N9504]
H01L21/762D8	. . . . .	[N: using bonding techniques] [N9504]
H01L21/762D8B	. . . . .	{7 dots} [N: with separation/delamination along an ion implanted layer, e.g. Smart-cut, Unibond] [N0011]
H01L21/762D8D	. . . . .	{7 dots} [N: using silicon etch back techniques, e.g. BESOI, ELTRAN] [N0011]
H01L21/762D8F	. . . . .	{7 dots} [N: with separation/delamination along a porous layer] [N0011]
H01L21/762D10	. . . . .	[N: using selective deposition of single crystal silicon, i.e. SEG techniques] [N0011]
H01L21/762D20	. . . . .	[N: SOI together with lateral isolation, e.g. using local oxidation of silicon, or dielectric or polycrystalline material refilled trench or air gap isolation regions, e.g. completely isolated semiconductor islands] [N0011]
H01L21/762D20A	. . . . .	{7 dots} [N: Vertical isolation by silicon implanted buried insulating layers, e.g. oxide layers, i.e. SIMOX techniques] [N0404]
H01L21/762D20B	. . . . .	{7 dots} [N: Vertical isolation by full isolation by porous oxide silicon, i.e. FIPOS techniques] [N0404]
H01L21/762D20C	. . . . .	{7 dots} [N: Vertical isolation by lateral overgrowth techniques, i.e. ELO techniques] [N0404]
H01L21/762D20D	. . . . .	{7 dots} [N: Vertical isolation by bonding techniques] [N0404]
H01L21/762D20E	. . . . .	{7 dots} [N: Vertical isolation by selective deposition of single crystal silicon, i.e. SEG techniques] [N0404]
H01L21/762D20L	. . . . .	{7 dots} [N: Lateral isolation by selective oxidation of silicon] [N0404]
H01L21/762D20M	. . . . .	{7 dots} [N: Lateral isolation by refilling of trenches with dielectric material] [N0404]
H01L21/762D20N	. . . . .	{7 dots} [N: Lateral isolation by refilling of trenches with polycrystalline material] [N0404]
H01L21/762D20P	. . . . .	{7 dots} [N: Lateral isolation by air gap] [N0404]
H01L21/762D20Q	. . . . .	{7 dots} [N: Lateral isolation by field effect] [N0404]
H01L21/762E	. . . . .	[N: using selective deposition of single crystal silicon, i.e. SEG techniques] [N9504]
H01L21/762F	. . . . .	[N: Dielectric isolation using EPIC techniques, i.e. epitaxial passivated integrated circuit] [N9504]
H01L21/763	. . . . .	Polycrystalline semiconductor regions [N: (H01L21/762D20 takes precedence)] [N9504] [C0404]
H01L21/764	. . . . .	Air gaps [N: (H01L21/762D20 takes precedence)] [N9504] [C0011]
H01L21/765	. . . . .	by field effect [N: (H01L21/762D20 takes precedence)] [N9504] [C0404]

- H01L21/768 . . . Applying interconnections to be used for carrying current between separate components within a device [N: comprising conductors and dielectrics]
- [N: **Notes**[N0909]
Groups [H01L21/768](#) to [H01L21/768T](#) cover multi-step processes for manufacturing interconnections.
Information peculiar to single-step processes should also be classified in the corresponding group, e.g.
- cleaning [H01L21/02F](#)
- etching [H01L21/311](#), [H01L21/3213](#)
- masking [H01L21/027](#), [H01L21/033](#), [H01L21/311D](#), [H01L21/3213D](#)
- planarizing [H01L21/3105](#), [H01L21/321](#)
]
- H01L21/768B [N: characterised by the formation and the after-treatment of the dielectrics, e.g. smoothing] [C9504]
- H01L21/768B2 [N: by forming openings in dielectrics] [C0708]
- H01L21/768B2B [N: by forming tapered via holes]
- H01L21/768B2C [N: the opening being a via or contact hole penetrating the underlying conductor] [N1204]
- H01L21/768B2D [N: for dual damascene structures] [N9907]
- H01L21/768B2D2 {7 dots} [N: involving intermediate temporary filling with material] [N0708] [C1101]
- H01L21/768B2D4 {7 dots} [N: involving one or more buried masks] [N0708]
- H01L21/768B2D6 {7 dots} [N: involving multiple stacked pre-patterned masks] [N0708]
- H01L21/768B2D8 {7 dots} [N: involving a partial via etch] [N1101]
- H01L21/768B2F [N: post-treatment or after-treatment, e.g. cleaning or removal of oxides on underlying conductors] [N0708] [C1207]
- [N: **WARNING**
[N1207]Groups [H01L21/768B2F-H01L21/768B2N](#) are not complete; see provisionally [H01L21/768B2](#)
]
- H01L21/768B2L üN: Aspects relating to the layout of the pattern or to the size of vias or trenches (layout of the interconnections per se H01L23/528; CAD of ICs G06F17/50)] [N0708]
- H01L21/768B2N [N: using printing or stamping techniques] [N0708]
- H01L21/768B4 [N: Smoothing of the dielectric (planarisation of insulating materials per se [H01L21/3105B](#))] [N9504]
- H01L21/768B6 [N: the dielectric comprising air gaps] [N9810]
- H01L21/768B8 [N: Modification of the material of dielectric layers, e.g. grading, after-treatment to improve the stability of the layers, to increase their density etc.] [N0708] [N: WARNING: Groups H01L21/768B8-H01L21/768B14 are not complete; see provisionally H01L21/768B] [C0708]
- H01L21/768B8B [N: transforming an insulating layer into a conductive layer] [N0708]
- H01L21/768B8D [N: by exposing the layer to particle radiation, e.g. ion implantation, irradiation with UV light or electrons etc.(plasma treatment H01L21/768B8P)] [N0708]
- H01L21/768B8P [N: by contacting the layer with gases, liquids or plasmas] [N0708]
- H01L21/768B8T [N: thermal treatment] [N0807]

H01L21/768B10	. . . . .	[N: characterised by the formation of thin functional dielectric layers, e.g. dielectric etch-stop, barrier, capping or liner layers] [N0708]
H01L21/768B10B	. . . . .	[N: in via holes or trenches, e.g. non-conductive sidewall liners] [N0708]
H01L21/768B10M	. . . . .	[N: Multiple layers] [N0708]
H01L21/768B10S	. . . . .	[N: formation of thin insulating films on the sidewalls or on top of conductors (H01L21/768B10B takes precedence)] [N0708]
H01L21/768B12	. . . . .	[N: Combinations of two or more different dielectric layers having a low dielectric constant (H01L21/768B10M takes precedence)] [N0708]
H01L21/768B14	. . . . .	[N: Filling up the space between adjacent conductive structures; Gap-filling properties of dielectrics] [N0708]
H01L21/768C	. . . . .	[N: characterised by the formation and the after-treatment of the conductors (etching for patterning the conductors H01L21/3213)] [C0006]

[N: **Note**

When the interconnect is also used as the conductor part of a conductor insulator semiconductor electrode (gate level interconnections), documents are classified in the relevant electrode manufacture groups, e.g.

[H01L21/28E2B](#)

]

H01L21/768C2	. . . . .	[N: Smoothing; Planarisation] [C9708]
H01L21/768C3	. . . . .	[N: Barrier, adhesion or liner layers] [N0103]
H01L21/768C3B	. . . . .	[N: formed in openings in a dielectric] [N0708] [C1101]
H01L21/768C3B2	. . . . .	{7 dots} [N: Bottomless liners] [N0708]
H01L21/768C3B4	. . . . .	{7 dots} [N: Layer combinations] [N0708]
H01L21/768C3B6	. . . . .	{7 dots} [N: the layer being positioned within the main fill metal] [N0708]
H01L21/768C3B8	. . . . .	{7 dots} [N: the layer being positioned on top of the main fill metal] [N0708]
H01L21/768C3C	. . . . .	[N: the layer covering a conductive structure (H01L21/768C3B8 takes precedence)] [N0708]
H01L21/768C3C2	. . . . .	{7 dots} [N: the layer also covering the sidewalls of the conductive structure] [N0708]
H01L21/768C3D	. . . . .	[N: characterized by particular after-treatment steps] [N0708]
H01L21/768C3D2	. . . . .	{7 dots} [N: After-treatment introducing at least one additional element into the layer] [N0708]
H01L21/768C3D2B	. . . . .	{8 dots} [N: by treatment in plasmas or gaseous environments, e.g. nitriding a refractory metal liner] [N0708]
H01L21/768C3D2D	. . . . .	{8 dots} [N: by diffusing alloying elements] [N0708]
H01L21/768C3D2F	. . . . .	{8 dots} [N: by ion implantation] [N0708]
H01L21/768C3D4	. . . . .	{7 dots} [N: Post-treatment or after-treatment not introducing additional chemical elements into the layer] [N0708] [C1207]
H01L21/768C3D4B	. . . . .	{8 dots} [N: Bombardment with particles, e.g. treatment in noble gas plasmas; UV irradiation] [N0708]
H01L21/768C3D4D	. . . . .	{8 dots} [N: Thermal treatment] [N0708]
H01L21/768C3D6	. . . . .	{7 dots} [N: Selective removal of parts of the layer (H01L21/768C3B2 takes precedence)] [C0708]
H01L21/768C3F	. . . . .	[N: characterized by methods of formation other than PVD, CVD or deposition from a liquids (PVD H01L21/285B4F; CVD

		21/285B4H; deposition from liquids H01L21/288)] [N0708]
H01L21/768C3H	. . . . .	[N: Forming or treating discontinuous thin films, e.g. repair, enhancement or reinforcement of discontinuous thin films] [N0708]
H01L21/768C3K	. . . . .	[N: Thin films associated with contacts of capacitors] [N0708]
H01L21/768C3S	. . . . .	[N: Layers specifically deposited to enhance or enable the nucleation of further layers, i.e. seed layers] [N0708]
H01L21/768C3S2	. . . . .	{7 dots} [N: for electroplating] [N0708]
H01L21/768C3S4	. . . . .	{7 dots} [N: for electroless plating] [N0708]
H01L21/768C3S6	. . . . .	{7 dots} [N: for deposition from the gas phase, e.g. CVD] [N0708]
H01L21/768C4	. . . . .	[N: Filling of holes, grooves or trenches, e.g. vias, with conductive material]
H01L21/768C4B	. . . . .	[N: by selective deposition of conductive material in the vias, e.g. selective C.V.D. on semiconductor material, plating (plating on semiconductors in general H01L21/288)]
H01L21/768C4C	. . . . .	[N: by deposition over sacrificial masking layer, e.g. lift-off (lift-off per se H01L21/00B2)]
H01L21/768C4E	. . . . .	[N: Reflowing or applying of pressure to better fill the contact hole] [N0006]
H01L21/768C4P	. . . . .	[N: Post-treatment or after-treatment of the conductive material] [N1204]
H01L21/768C6	. . . . .	[N: By forming conductive members before deposition of protective insulating material, e.g. pillars, studs] [C1207]
H01L21/768C8	. . . . .	[N: Modifying permanently or temporarily the pattern or the conductivity of conductive members, e.g. formation of alloys, reduction of contact resistances] [C1207]
H01L21/768C8B	. . . . .	[N: By rendering at least a portion of the conductor non conductive, e.g. oxidation] [C1207]
H01L21/768C8C	. . . . .	[N: by forming silicides of refractory metals]
H01L21/768C8D	. . . . .	[N: by using supraconducting materials]
H01L21/768C8L	. . . . .	[N: modifying the pattern] [N9809]
H01L21/768C8L2	. . . . .	{7 dots} [N: using a laser, e.g. laser cutting, laser direct writing, laser repair] [N9809]
H01L21/768C10	. . . . .	[N: Local interconnects; Local pads, as exemplified by patent document EP0896365] [N9907] [C9908]
H01L21/768S	. . . . .	[N: Formation of self-aligned vias or contact plugs, i.e. involving a lithographically uncritical step (self-aligned silicidation on field effect transistors H01L21/336M)] [N1108] [C1207]
H01L21/768T	. . . . .	[N: formed through a semiconductor substrate] [N9805]
H01L21/77	. . . . .	Manufacture or treatment of devices consisting of a plurality of solid state components or integrated circuits formed in, or on, a common substrate [N9504]

[N: Note

Integration processes for the manufacture of devices of the type classified in [H01L27/14](#) to [H01L27/32](#) are not classified in this group and its sub-groups. Instead, as they are peculiar to said devices, they are classified together with the devices Multistep processes for manufacturing memory structures in general using field effect technology are covered by [H01L27/105M](#); Multistep processes for manufacturing dynamic random access memory structures are covered by [H01L27/108M](#); Multistep processes for manufacturing static random access memory structures are covered by [H01L27/11](#); Multistep processes for

manufacturing read-only memory structures are covered by [H01L27/112](#); Multistep processes for manufacturing electrically programmable read-only memory structures are covered by [H01L27/115](#) [C1207]
]

- H01L21/78 . . . with subsequent division of the substrate into plural individual devices ([cutting to change the surface-physical characteristics or shape of semiconductor bodies H01L21/304](#)) [C9504]
- H01L21/78B [N: involving the separation of the active layers from a substrate] [N9506]
- H01L21/78B2 [N: leaving a reusable substrate, e.g. epitaxial lift off] [N9506]
- H01L21/782 to produce devices, each consisting of a single circuit element ([H01L21/82 takes precedence](#)) [N9504]
- H01L21/784 the substrate being a semiconductor body [N9504]
- H01L21/786 the substrate being other than a semiconductor body, e.g. insulating body [N9504]
- H01L21/82 to produce devices, e.g. integrated circuits, each consisting of a plurality of components [C9504]
- H01L21/82D [N: the substrate being a semiconductor, using diamond technology ([H01L21/8258 takes precedence](#))] [N9907]
- H01L21/82H [N: the substrate being a semiconductor, using SiC technology ([H01L21/8258 takes precedence](#))] [N9611]
- H01L21/822 the substrate being a semiconductor, using silicon technology ([H01L21/8258 takes precedence](#)) [N9504]
- H01L21/822B [N: Three dimensional integrated circuits stacked in different levels] [N9504]
- H01L21/8222 Bipolar technology [N9504]
- H01L21/8224 {7 dots} comprising a combination of vertical and lateral transistors [N9504]
- H01L21/8226 {7 dots} comprising merged transistor logic or integrated injection logic [N9504]
- H01L21/8228 {7 dots} Complementary devices, e.g. complementary transistors [N9504]
- H01L21/8228B {8 dots} [N: Complementary vertical transistors] [N9504]
- H01L21/8229 {7 dots} Memory structures [N9504]
- H01L21/8232 Field-effect technology [N9504]
- H01L21/8234 {7 dots} MIS technology [N:, i.e. integration processes of field effect transistors of the conductor-insulator-semiconductor type] [N9504] [C0201]
- H01L21/8234B {8 dots} [N: Combination of charge coupled devices, i.e. CCD, or BBD] [N9504]
- H01L21/8234C {8 dots} [N: with a particular manufacturing method of the channel structures, e.g. channel implants, halo or pocket implants, or channel materials] [N0201]
- H01L21/8234D {8 dots} [N: with a particular manufacturing method of the source or drain structures, e.g. specific source or drain implants or silicided source or drain structures or raised source or drain structures] [N0201]
- H01L21/8234D2 {9 dots} [N: manufacturing common source or drain regions between a plurality of conductor-insulator-semiconductor structures] [N0201]

H01L21/8234F	. . . . .	{8 dots} [N: with a particular manufacturing method of transistors with a horizontal current flow in a vertical sidewall of a semiconductor body, e.g. FinFET, MuGFET] [N1009]
H01L21/8234G	. . . . .	{8 dots} [N: with a particular manufacturing method of the gate conductors, e.g. particular materials, shapes] [N0201]
H01L21/8234G2	. . . . .	{9 dots} [N: silicided or salicided gate conductors] [N0201]
H01L21/8234G4	. . . . .	{9 dots} [N: gate conductors with different gate conductor materials or different gate conductor implants, e.g. dual gate structures] [N0201]
H01L21/8234G6	. . . . .	{9 dots} [N: gate conductors with different shapes, lengths or dimensions] [N0201]
H01L21/8234J	. . . . .	{8 dots} [N: with a particular manufacturing method of the gate insulating layers, e.g. different gate insulating layer thicknesses, particular gate insulator materials or particular gate insulator implants] [N0201]
H01L21/8234S	. . . . .	{8 dots} [N: with a particular manufacturing method of the gate sidewall spacers, e.g. double spacers, particular spacer material or shape] [N0201]
H01L21/8234T	. . . . .	{8 dots} [N: interconnection or wiring or contact manufacturing related aspects] [N0201]
H01L21/8234U	. . . . .	{8 dots} [N: isolation region manufacturing related aspects, e.g. to avoid interaction of isolation region with adjacent structure] [N0201]
H01L21/8234V	. . . . .	{8 dots} [N: with a particular manufacturing method of vertical transistor structures, i.e. with channel vertical to the substrate surface (with a current flow parallel to the substrate surface H01L21/8234F)] [N0201] [C1009]
H01L21/8234W	. . . . .	{8 dots} [N: with a particular manufacturing method of the wells or tubs, e.g. twin tubs, high energy well implants, buried implanted layers for lateral isolation (BILLI)] [N0201]
H01L21/8236	. . . . .	{8 dots} Combination of enhancement and depletion transistors [N9504]
H01L21/8238	. . . . .	{8 dots} Complementary field-effect transistors, e.g. CMOS [N9504]
H01L21/8238C	. . . . .	{9 dots} [N: with a particular manufacturing method of the channel structures, e.g. channel implants, halo or pocket implants, or channel materials] [N0201]
H01L21/8238D	. . . . .	{9 dots} [N: with a particular manufacturing method of the source or drain structures, e.g. specific source or drain implants or silicided source or drain structures or raised source or drain structures] [N0201]
H01L21/8238F	. . . . .	{9 dots} [N: with a particular manufacturing method of transistors with a horizontal current flow in a vertical sidewall of a semiconductor body, e.g. FinFET, MuGFET] [N1009]
H01L21/8238G	. . . . .	{9 dots} [N: with a particular manufacturing method of the gate conductors, e.g. particular materials, shapes] [N0201]
H01L21/8238G2	. . . . .	{10 dots} [N: silicided or salicided gate conductors] [N0201]
H01L21/8238G4	. . . . .	{10 dots} [N: gate conductors with different gate conductor materials or different gate conductor implants, e.g. dual gate structures][N0201]
H01L21/8238G6	. . . . .	{10 dots} [N: gate conductors with different shapes,

		lengths or dimensions] [N0201]
H01L21/8238J	. . . . .	{9 dots} [N: with a particular manufacturing method of the gate insulating layers, e.g. different gate insulating layer thicknesses, particular gate insulator materials or particular gate insulator implants] [N0201]
H01L21/8238S	. . . . .	{9 dots} [N: with a particular manufacturing method of the gate sidewall spacers, e.g. double spacers, particular spacer material or shape] [N0201]
H01L21/8238T	. . . . .	{9 dots} [N: interconnection or wiring or contact manufacturing related aspects] [N0201]
H01L21/8238U	. . . . .	{9 dots} [N: isolation region manufacturing related aspects, e.g. to avoid interaction of isolation region with adjacent structure] [N0201]
H01L21/8238V	. . . . .	{9 dots} [N: with a particular manufacturing method of vertical transistor structures, i.e. with channel vertical to the substrate surface (with a current flow parallel to the substrate surface H01L21/8238E)] [N0201] [C1009]
H01L21/8238W	. . . . .	{9 dots} [N: with a particular manufacturing method of the wells or tubs, e.g. twin tubs, high energy well implants, buried implanted layers for lateral isolation (BILLI)] [N0201]
H01L21/8239	. . . . .	{8 dots} Memory structures [N9504]
H01L21/8248	. . . . .	Combination of bipolar and field-effect technology [N9504]
H01L21/8249	. . . . .	{7 dots} Bipolar and MOS technology [N9504]
H01L21/8252	. . . . .	the substrate being a semiconductor, using III-V technology (H01L21/8258 takes precedence) [N9504]
H01L21/8254	. . . . .	the substrate being a semiconductor, using II-VI technology (H01L21/8258 takes precedence) [N9504]
H01L21/8256	. . . . .	the substrate being a semiconductor, using technologies not covered by one of groups [N: H01L21/82D , H01L21/82H], H01L21/822 , H01L21/8252 and H01L21/8254 (H01L21/8258 takes precedence) [N9504] [C9907]
H01L21/8258	. . . . .	the substrate being a semiconductor, using a combination of technologies covered by [N: H01L21/82D , H01L21/82H], H01L21/822 , H01L21/8252 , H01L21/8254 or H01L21/8256 [N9504] [C9907]
H01L21/84	. . . . .	the substrate being other than a semiconductor body, e.g. being an insulating body [C9504]
H01L21/84F	. . . . .	[N: including field-effect transistors with a horizontal current flow in a vertical sidewall of a semiconductor body, e.g. FinFET, MuGFET] [N1009]
H01L21/86	. . . . .	the insulating body being sapphire, e.g. silicon on sapphire structure, i.e. SOS [C9504]
H01L22/00		[N: Testing or measuring during manufacture or treatment; Reliability measurements, i.e. testing of parts without further processing to modify the parts as such; Structural arrangements therefor (detecting or counting or handling H01L21/67S ; marks applied to semiconductor devices H01L23/544 ; testing methods or structures peculiar to devices provided for in groups H01L31/00 to H01L51/00 , see these groups; investigating or analysing materials by the use of optical means G01N21/00 ; testing electrical properties of individual semiconductor devices G01R31/26 ; testing of photovoltaic systems H02S50/00)] [N1204]
H01L22/10	. . . . .	[N: Measuring as part of the manufacturing process (burn-in G01R31/28C8)] [N1204]

- H01L22/12 . . [N: for structural parameters, e.g. thickness, line width, refractive index, temperature, warp, bond strength, defects, optical inspection, electrical measurement of structural dimensions, metallurgic measurement of diffusions (electrical measurement of diffusions H01L22/14)] [N1204]
- H01L22/14 . . [N: for electrical parameters, e.g. resistance, deep-levels, CV, diffusions by electrical means] [N1204]
- H01L22/20 . [N: Sequence of activities consisting of a plurality of measurements, corrections, marking or sorting steps] [N1204] [C1208]
- H01L22/22 . . [N: Connection or disconnection of sub-entities or redundant parts of a device in response to a measurement (testing and repair of stores after manufacture including at wafer scale G11C29/00; fuses per se H01L23/525)] [N1204]
- H01L22/24 . . [N: Optical enhancement of defects or not directly visible states, e.g. selective electrolytic deposition, bubbles in liquids, light emission, colour change (voltage contrast G01R31/311)] [N1204]
- H01L22/26 . . [N: Acting in response to an ongoing measurement without interruption of processing, e.g. endpoint detection, in-situ thickness measurement (endpoint detection arrangements in CMP apparatus B24B37/013, in discharge apparatus H01J37/32D1C1)] [N1204]
- H01L22/30 . [N: Structural arrangements specially adapted for testing or measuring during manufacture or treatment, or specially adapted for reliability measurements] [N1204]
- H01L22/32 . . [N: Additional lead-in metallisation on a device or substrate, e.g. additional pads or pad portions, lines in the scribe line, sacrificed conductors (arrangements for conducting electric current to or from the solid state body in operation [H01L23/48](#))] [N1204]
- H01L22/34 . . [N: Circuits for electrically characterising or monitoring manufacturing processes, e.g. whole test die, wafers filled with test structures, on-board-devices incorporated on each die, process control monitors or pad structures thereof, devices in scribe line (switching, multiplexing, gating devices G01R19/25; process control with lithography, e.g. dose control, G03F7/20; structures for alignment control by optical means G03F7/20T8)] [N1204]

H01L23/00 **Details of semiconductor or other solid state devices** ([H01L25/00](#) takes precedence; [N: structural arrangements for testing or measuring during manufacture or treatment, or for reliability measurements [H01L22/00](#); arrangements for connecting or disconnecting semiconductor or solid-state bodies, or methods related thereto [H01L24/00](#); finger print sensors [G06K9/00A](#)]) [C1205]

Note

This group does not cover:

- details of semiconductor bodies or of electrodes of devices provided for in group [H01L29/00](#), which details are covered by that group;
- details peculiar to devices provided for in a single main group of groups [H01L31/00](#) to [H01L51/00](#), which details are covered by those groups.

- H01L23/02 . Containers; Seals ([H01L23/12](#), [H01L23/34](#), [H01L23/48](#), [H01L23/552](#), [N: [H01L23/66](#)] take precedence; [N: for memories [G11C](#)]) [C9602]
- H01L23/04 . . characterised by the shape [N: of the container or parts, e.g. caps, walls]
- H01L23/04B . . . [N: the container being a hollow construction having no base used as a mounting for the semiconductor body] [N9602]

- H01L23/043 . . . the container being a hollow construction and having a conductive base as a mounting as well as a lead for the semiconductor body
- H01L23/045 the other leads having an insulating passage through the base
- H01L23/047 the other leads being parallel to the base
- H01L23/049 the other leads being perpendicular to the base
- H01L23/051 another lead being formed by a cover plate parallel to the base plate, e.g. sandwich type
- H01L23/053 . . . the container being a hollow construction and having an insulating [N: or insulated] base as a mounting for the semiconductor body
- H01L23/055 the leads having a passage through the base [N: ([H01L23/057](#) takes precedence)]
- H01L23/057 the leads being parallel to the base
- H01L23/06 . . characterised by the material of the container or its electrical properties
- H01L23/08 . . . the material being an electrical insulator, e.g. glass
- H01L23/10 . . characterised by the material or arrangement of seals between parts,ween cap e.g. between cap and base of the container or between leads and walls of the container

- H01L23/12 . Mountings, e.g. non-detachable insulating substrates
- H01L23/13 . . characterised by the shape
- H01L23/14 . . characterised by the material or its electrical properties [N: ([printed circuit boards H05K1/00](#))]
- H01L23/14M . . . [N: Metallic substrates having insulating layers]
- H01L23/14P . . . [N: Organic substrates, e.g. plastic]
- H01L23/14S . . . [N: Semiconductor insulating substrates ([semiconductor conductive substrates H01L23/492M2](#))]
- H01L23/15 . . . Ceramic or glass substrates [N: ([H01L23/14M](#), [H01L23/14P](#), [H01L23/14S](#) take precedence)]

- H01L23/16 . Fillings or auxiliary members in containers [N: or encapsulations], e.g. centering rings ([H01L23/42](#), [H01L23/552](#) take precedence)
- H01L23/18 . . Fillings characterised by the material, its physical or chemical properties, or its arrangement within the complete device

- Note**
Group [H01L23/26](#) takes precedence over groups [H01L23/20](#) to [H01L23/24](#)
- H01L23/20 . . . gaseous at the normal operating temperature of the device
- H01L23/22 . . . liquid at the normal operating temperature of the device
- H01L23/24 . . . Solid or gel at the normal operating temperature of the device [N: ([H01L23/31H4](#) takes precedence)]
- H01L23/26 . . . including materials for absorbing or reacting with moisture or other undesired substances, [N: e.g. getters]

- H01L23/28 . Encapsulations, e.g. encapsulating layers, coatings, [N: e.g. for protection] ([H01L23/552](#) takes precedence; [N: insulating layers for contacts or interconnections [H01L23/532N](#)]) [C9601]
- H01L23/29 . . characterised by the material [N: e.g. carbon ([interlayer dielectrics H01L23/532N](#))] [C9601]
- H01L23/29C . . . [N: Oxides or nitrides or carbides, e.g. ceramics, glass]
- H01L23/29P . . . [N: Organic, e.g. plastic]

- H01L23/29P4 [N: containing a filler ([H01L23/29P6](#) takes precedence)]
- H01L23/29P6 [N: Organo-silicon compounds]
- H01L23/29S [N: Semiconductor material, e.g. amorphous silicon]
- H01L23/31 . . characterised by the arrangement [N: or shape]
- H01L23/31H [N: the device being completely enclosed]
- H01L23/31H1 [N: the device being a chip scale package, e.g. CSP] [N0306]
- H01L23/31H2 [N: a substrate forming part of the encapsulation]
- H01L23/31H2B [N: the substrate having spherical bumps for external connection] [N0306]
- H01L23/31H4 [N: Double encapsulation or coating and encapsulation]
- H01L23/31H6 [N: Sealing arrangements between parts, e.g. adhesion promoters]
- H01L23/31H8 [N: the encapsulation having a cavity]
- H01L23/31P [N: Partial encapsulation or coating (**mask layer used as insulation layer** [H01L21/31](#))]
- H01L23/31P4 [N: the coating being a foil]
- H01L23/31P6 [N: the coating being directly applied to the semiconductor body, e.g. passivation layer ([H01L23/31P8](#) takes precedence)]
- H01L23/31P8 [N: Coating or filling in grooves made in the semiconductor body]
- H01L23/31P10 [N: the coating covering also the sidewalls of the semiconductor body]
- H01L23/31P12 [N: Multilayer coating]

- H01L23/32 . . Holders for supporting the complete device in operation, i.e. detachable fixtures ([H01L23/40](#) takes precedence; connectors, [N: e.g. sockets], in general [H01R](#); for printed circuits [H05K](#))

- H01L23/34 . . Arrangements for cooling, heating, ventilating or temperature compensation; [N: Temperature sensing arrangements (**thermal treatment apparatus** [H01L21/00](#))]
- H01L23/34H [N: Arrangements for heating (**thermal treatment apparatus** [H01L21/00](#))]
- H01L23/36 . . Selection of materials, or shaping, to facilitate cooling or heating, e.g. heatsinks [N: ([H01L23/28](#), [H01L23/40](#), [H01L23/42](#), [H01L23/44](#), [H01L23/46](#) take precedence; heating [H01L23/34H](#))]
- H01L23/367 Cooling facilitated by shape of device [N: ([H01L23/38](#), [H01L23/40](#), [H01L23/42](#), [H01L23/44](#), [H01L23/46](#) take precedence)]
- H01L23/367F [N: Foil-like cooling fins or heat sinks (**being part of lead-frames** [H01L23/495H](#))]
- H01L23/367H [N: characterised by the shape of the housing]
- H01L23/367W [N: Wire-like or pin-like cooling fins or heat sinks]
- H01L23/373 Cooling facilitated by selection of materials for the device [N: or materials for thermal expansion adaptation, e.g. carbon]
- H01L23/373C [N: Ceramic materials or glass ([H01L23/373D](#), [H01L23/373H](#), [H01L23/373L](#), [H01L23/373P](#), [H01L23/373S](#) take precedence)]
- H01L23/373D [N: Diamonds]
- H01L23/373H [N: having a heterogeneous or anisotropic structure, e.g. powder or fibres in a matrix, wire mesh, porous structures ([H01L23/373D](#), [H01L23/373P](#) take precedence)]
- H01L23/373L [N: Laminates or multilayers, e.g. direct bond copper ceramic substrates]
- H01L23/373M [N: Metallic materials ([H01L23/373D](#), [H01L23/373H](#), [H01L23/373L](#), [H01L23/373P](#), [H01L23/373S](#) take precedence)]

- H01L23/373P [N: Organic materials with or without a thermoconductive filler]
- H01L23/373S [N: Semiconductor materials]
- H01L23/38 . . Cooling arrangements using the Peltier effect
- H01L23/40 . . Mountings or securing means for detachable cooling or heating arrangements [N: (heating [H01L23/34H](#)); fixed by friction, plugs or springs]
- H01L23/40B [N: with bolts or screws]
- H01L23/40B8 [N: for stacked arrangements of a plurality of semiconductor devices (assemblies per se [H01L25/00](#))]
- H01L23/40S [N: Snap-on arrangements, e.g. clips]
- H01L23/42 . . Fillings or auxiliary members in containers [N: or encapsulations] selected or arranged to facilitate heating or cooling ([N: heating [H01L23/34H](#)]; characterised by selection of materials for the device [H01L23/373](#))
- H01L23/427 Cooling by change of state, e.g. use of heat pipes [N: (by liquefied gas [H01L23/44C](#))]
- H01L23/427S [N: by melting or evaporation of solids]
- H01L23/433 Auxiliary members [N: in containers] characterised by their shape, e.g. pistons
- H01L23/433B [N: Bellows] [N9410]
- H01L23/433E [N: Auxiliary members in encapsulations ([H01L23/495H](#) takes precedence)]
- H01L23/433J [N: in combination with jet impingement] [N9410]
- H01L23/433P [N: Pistons, e.g. spring-loaded members] [N9410]
- H01L23/44 . . the complete device being wholly immersed in a fluid other than air [N: ([H01L23/427](#) takes precedence)]
- H01L23/44C [N: the fluid being a liquefied gas, e.g. in a cryogenic vessel]
- H01L23/46 . . involving the transfer of heat by flowing fluids ([H01L23/42](#), [H01L23/44](#) take precedence)
- H01L23/467 by flowing gases, e.g. air [N: ([H01L23/473](#) takes precedence)]
- H01L23/473 by flowing liquids [N: ([H01L23/433B](#), [H01L23/433P](#) take precedence)] [C9410]
- H01L23/473J [N: Jet impingement ([H01L23/433J](#) takes precedence)] [N9410]
- H01L23/48 . . Arrangements for conducting electric current to or from the solid state body in operation, e.g. leads, terminal arrangements (in general H01R); [N: Selection of materials therefor]
- [N: **Note** [C1108]
Arrangements for connecting or disconnecting semiconductor or other solid state bodies, or methods related thereto, other than those arrangements or methods covered by the following subgroups, are covered by [H01L24/00](#)
]
- H01L23/48J . . [N: Internal lead connections, e.g. via connections, feedthrough structures]
- H01L23/482 . . consisting of lead-in layers inseparably applied to the semiconductor body [N: (electrodes [H01L29/40](#))]
- [N: **WARNING** [C1108]
The documents of this group dealing with arrangements for connecting semiconductor or other solid state bodies are being continuously reclassified to [H01L24/01](#) and subgroups
]
- H01L23/482A [N: Bridge structure with air gap]
- H01L23/482B [N: Beam leads]

- H01L23/482E . . . [N: Pads with extended contours, e.g. grid structure, branch structure, finger structure]
- H01L23/482J . . . [N: for devices consisting of semiconductor layers on insulating or semi-insulating substrates, e.g. silicon on sapphire devices, i.e. SOS]
- H01L23/482M . . . [N: Materials]
- H01L23/482M4 [N: Conductive organic material or pastes, e.g. conductive adhesives, inks]
- H01L23/485 . . . consisting of layered constructions comprising conductive layers and insulating layers, e.g. planar contacts [N: ([H01L23/482A](#), [H01L23/482B](#), [H01L23/482E](#), [H01L23/482J](#) take precedence; materials [H01L23/532](#), bond pads [H01L24/02](#), bump connectors [H01L24/10](#))] [C1108]
- [N: **WARNING** [C1108]
The documents of this group dealing with arrangements for connecting semiconductor or other solid state bodies are being continuously reclassified to [H01L24/01](#) and subgroups
]
- H01L23/485H [N: Overhang structure]
- H01L23/488 . . . consisting of soldered [N: or bonded] constructions [N: (bump connectors [H01L24/01](#))] [C1108]
- H01L23/49 . . . Wire-like [N: arrangements or pins or rods (using optical fibres [H01L23/48](#); pins attached to insulating substrates [H01L23/498C](#))]
- [N: **WARNING** [N1006]
This group is no longer used for the classification of new documents as from June 1, 2010. The backlog of this group is being continuously reclassified to [H01L23/00C2W](#) and subgroups
]
- H01L23/492 . . . Bases or plates [N: or solder therefor]
- H01L23/492H [N: having a heterogeneous or anisotropic structure]
- H01L23/492M [N: characterised by the materials]
- H01L23/492M2 [N: the materials containing semiconductor material]
- H01L23/492M3 [N: the materials containing carbon]
- H01L23/495 . . . Lead-frames [N: or other flat leads ([H01L23/498](#) takes precedence; lead frame interconnections between components [H01L23/52](#))]
- H01L23/495A [N: characterised by the die pad]
- H01L23/495A2 [N: an insulative substrate being used as a diepad, e.g. ceramic, plastic ([H01L23/495C8](#) takes precedence)] [C9410]
- H01L23/495A4 [N: Chip-on-leads or leads-on-chip techniques, i.e. inner lead fingers being used as die pad]
- H01L23/495A6 [N: having bonding material between chip and die pad]
- H01L23/495C [N: Additional leads]
- H01L23/495C2 [N: the additional leads being a bump or a wire] [N9410]
- H01L23/495C4 [N: the additional leads being a tape carrier or flat leads] [N9410]
- H01L23/495C6 [N: the additional leads being a multilayer] [N9410]
- H01L23/495C8 [N: the additional leads being a wiring board] [N9410]
- H01L23/495D [N: Multi-layer]
- H01L23/495F [N: Plurality of lead frames mounted in one device]
- H01L23/495G [N: Geometry of the lead-frame]

H01L23/495G2	. . . . .	[N: Deformation absorbing parts in the lead frame plane, e.g. meanderline shape (H01L23/495G8 takes precedence)]
H01L23/495G4	. . . . .	[N: Cross section geometry (H01L23/495G8 takes precedence)]
H01L23/495G4B	. . . . .	[N: characterised by bent parts]
H01L23/495G4B6	. . . . .	{7 dots} [N: the bent parts being the outer leads]
H01L23/495G6	. . . . .	[N: Insulating layers on lead frames, e.g. bridging members]
H01L23/495G8	. . . . .	[N: for devices being provided for in H01L29/00]
H01L23/495G9	. . . . .	[N: Side rails of the lead frame, e.g. with perforations, sprocket holes] [N9609]
H01L23/495H	. . . . .	[N: specifically adapted to facilitate heat dissipation]
H01L23/495J	. . . . .	[N: consisting of thin flexible metallic tape with or without a film carrier (H01L23/495A to H01L23/495H and H01L23/495L to H01L23/495M take precedence)] [C9609]
H01L23/495L	. . . . .	[N: Assemblies of semiconductor devices on lead frames]
H01L23/495M	. . . . .	[N: characterised by the materials of the lead frames or layers thereon]
H01L23/495M1	. . . . .	[N: Metallic layers on lead frames]
H01L23/495M8	. . . . .	[N: Insulating layers on lead frames]
H01L23/495Q	. . . . .	[N: Capacitor integral with or on the leadframe]
H01L23/495R	. . . . .	[N: Battery in combination with a leadframe] [N9410]
H01L23/495S	. . . . .	[N: Oscillators in combination with lead-frames] [N9506]
H01L23/498	. . . . .	Leads, [N: i.e. metallisations or lead-frames] on insulating substrates, [N: e.g. chip carriers (shape of the substrate H01L23/13)]
H01L23/498A	. . . . .	[N: the leads being also applied on the sidewalls or the bottom of the substrate, e.g. leadless packages for surface mounting]
H01L23/498C	. . . . .	[N: Additional leads joined to the metallisation on the insulating substrate, e.g. pins, bumps, wires, flat leads (H01L23/498E takes precedence)]
H01L23/498C4	. . . . .	[N: Spherical bumps on the substrate for external connection, e.g. ball grid arrays (BGA)] [N9701]
H01L23/498D	. . . . .	[N: Multilayer substrates (multilayer metallisation on monolayer substrate H01L23/498)]
H01L23/498E	. . . . .	[N: Via connections through the substrates, e.g. pins going through the substrate, coaxial cables (H01L23/498D , H01L23/498F , H01L23/498J , H01L23/498L take precedence)]
H01L23/498F	. . . . .	[N: the chip support structure consisting of a plurality of insulating substrates]
H01L23/498G	. . . . .	[N: Geometry or layout]
H01L23/498G8	. . . . .	[N: for devices being provided for in H01L29/00]
H01L23/498J	. . . . .	[N: Flexible insulating substrates (H01L23/495J and H01L23/498K take precedence)] [C9609]
H01L23/498K	. . . . .	[N: for flat-cards, e.g. credit cards (cards per se G06K19/00)]
H01L23/498L	. . . . .	[N: Lead-frames fixed on or encapsulated in insulating substrates (H01L23/498J , H01L23/498A take precedence)]
H01L23/498M	. . . . .	[N: characterised by the materials (materials of the substrates H01L23/14 , of the lead-frames H01L23/495M)]
H01L23/498M2	. . . . .	[N: the conductive materials containing semiconductor material]
H01L23/498M3	. . . . .	[N: Carbon, e.g. fullerenes (superconducting fullerenes H01L39/12B2)]
H01L23/498M4	. . . . .	[N: the conductive materials containing organic materials or pastes, e.g. for thick films (for printed circuits H05K1/09D)]

- H01L23/498M6 [N: the conductive materials containing superconducting material]
- H01L23/498M8 [N: Materials of the insulating layers or coatings]
- H01L23/50 for integrated circuit devices, [N: e.g. power bus, number of leads] ([H01L23/482](#) to [H01L23/498](#) take precedence)

- H01L23/52 Arrangements for conducting electric current within the device in operation from one component to another, [N: i.e. interconnections, e.g. wires, lead frames (**optical interconnections** [G02B6/00](#))]

- H01L23/522 including external interconnections consisting of a multilayer structure of conductive and insulating layers inseparably formed on the semiconductor body
- H01L23/522A [N: Crossover interconnections]
- H01L23/522C [N: Capacitive arrangements or effects of, or between wiring layers (**other capacitive arrangements** [H01L23/64C](#))]
- H01L23/522C4 [N: Capacitor integral with wiring layers] [N0506]
- H01L23/522C6 [N: Shielding layers formed together with wiring layers] [N0506]
- H01L23/522E [N: Via connections in a multilevel interconnection structure]
- H01L23/522L [N: Inductive arrangements or effects of, or between, wiring layers (**other inductive arrangements** [H01L23/64L](#))] [N0306]
- H01L23/522R [N: Resistive arrangements or effects of, or between, wiring layers (**other resistive arrangements** [H01L23/64R](#))] [N0306]
- H01L23/525 with adaptable interconnections
- H01L23/525A [N: comprising anti-fuses, i.e. connections having their state changed from non-conductive to conductive]
- H01L23/525A4 [N: the change of state resulting from the use of an external beam, e.g. laser beam or ion beam]
- H01L23/525F [N: comprising fuses, i.e. connections having their state changed from conductive to non-conductive]
- H01L23/525F4 [N: the change of state resulting from the use of an external beam, e.g. laser beam or ion beam]
- H01L23/528 [N: Geometry or] layout of the interconnection structure [N: ([H01L27/02B2](#) takes precedence; algorithms [G06F17/50](#))]
- H01L23/528C [N: Cross-sectional geometry] [N9511]
- H01L23/528P [N: Arrangements of power or ground buses] [N9506]
- H01L23/532 characterised by the materials [C9410]
- H01L23/532M [N: Conductive materials] [N9410]
- H01L23/532M1 [N: based on metals, e.g. alloys, metal silicides ([H01L23/532M6](#) takes precedence)] [N9410]
- H01L23/532M1A [N: the principal metal being aluminium] [N9410]
- H01L23/532M1A2 {7 dots} [N: Aluminium alloys] [N9410]
- H01L23/532M1A4 {7 dots} [N: Additional layers associated with aluminium layers, e.g. adhesion, barrier, cladding layers] [N9410]
- H01L23/532M1C [N: the principal metal being copper] [N9410]
- H01L23/532M1C2 {7 dots} [N: Copper alloys] [N0306]
- H01L23/532M1C4 {7 dots} [N: Additional layers associated with copper layers, e.g. adhesion, barrier, cladding layers][N0306]
- H01L23/532M1N [N: the principal metal being a noble metal, e.g. gold] [N9410]
- H01L23/532M1N2 {7 dots} [N: Noble-metal alloys] [N0306]

- H01L23/532M1N4 {7 dots} [N: Additional layers associated with noble-metal layers, e.g. adhesion, barrier, cladding layers] [N0306]
- H01L23/532M1R [N: the principal metal being a refractory metal] [N9410]
- H01L23/532M1R2 {7 dots} [N: Refractory-metal alloys] [N0306]
- H01L23/532M1R4 {7 dots} [N: Additional layers associated with refractory-metal layers, e.g. adhesion, barrier, cladding layers] [N0306]
- H01L23/532M2 [N: containing semiconductor material, e.g. polysilicon] [N9410]
- H01L23/532M3 [N: containing carbon, e.g. fullerenes (**superconducting fullerenes** [H01L39/12B2](#))] [N9410]
- H01L23/532M4 [N: containing conductive organic materials or pastes, e.g. conductive adhesives, inks] [N9410]
- H01L23/532M6 [N: containing superconducting materials] [N9410]
- H01L23/532N [N: Insulating materials] [N9410]
- H01L23/532N4 [N: Stacked insulating layers] [N0306]
- H01L23/535 . . . including internal interconnections, e.g. cross-under constructions [N: (**internal lead connections** [H01L23/48J](#))]
- H01L23/538 . . . the interconnection structure between a plurality of semiconductor chips being formed on, or in, insulating substrates [N: [H05K](#) takes precedence; manufacture or treatment [H01L21/48C4](#); mountings per se [H01L23/12](#); [N: materials [H01L23/498M](#))]
- H01L23/538A . . . [N: Crossover interconnections, e.g. bridge stepovers]
- H01L23/538B . . . [N: Adaptable interconnections, e.g. for engineering changes]
- H01L23/538D . . . [N: Multilayer substrates ([H01L23/538F](#) takes precedence; **multilayer metallisation on monolayer substrates** [H01L23/538](#))]
- H01L23/538E . . . [N: Conductive vias through the substrate with or without pins, e.g. buried coaxial conductors ([H01L23/538D](#), [H01L23/538F](#) take precedence; pins attached to insulating substrates [H01L23/498C](#))]
- H01L23/538F . . . [N: Assembly of a plurality of insulating substrates]
- H01L23/538G . . . [N: Geometry or layout of the interconnection structure]
- H01L23/538J . . . [N: Flexible insulating substrates ([H01L23/538K](#) takes precedence)]
- H01L23/538K . . . [N: for flat cards, e.g. credit cards (**cards per se** [G06K19/00](#))]
- H01L23/538V . . . [N: the chips being integrally enclosed by the interconnect and support structures] [C9704]

- H01L23/544 . . . Marks applied to semiconductor devices [N: or parts], e.g. registration marks, [N: alignment structures, wafer maps (**test patterns for characterising or monitoring manufacturing processes** [H01L22/00](#))] [C1205]

- [N: **Notes**
[N1207]When classifying in group [H01L23/544](#), details are to be further indexed by using the ICO codes chosen from [T01L223/544](#) and subgroups
]

- H01L23/552 . . . Protection against radiation, e.g. light [N: or electromagnetic waves]
- H01L23/556 . . . against alpha rays

- H01L23/562 . . . [N: Protection against mechanical damage (H01L23/02, H01L23/28 take precedence)] [N1204]

- H01L23/564 . . . [N: Details not otherwise provided for, e.g. protection against moisture (getters

- H01L23/26)] [N1204]
- H01L23/57 . [N: Protection from inspection, reverse engineering or tampering] [N1204]
 - H01L23/57A . . [N: using passive means] [N1204]
 - H01L23/57B . . [N: using active circuits] [N1204]
 - H01L23/58 . Structural electrical arrangements for semiconductor devices not otherwise provided for, [N: e.g. in combination with batteries ([H01L23/495R](#), [H01L23/495S](#) take precedence)] [C9506]
 - H01L23/58B . . [N: comprising conductive layers or plates or strips or rods or rings ([H01L23/60](#), [H01L23/62](#), [H01L23/64](#), [H01L23/66](#) take precedence)]
 - H01L23/60 . . Protection against electrostatic charges or discharges, e.g. Faraday shields (in general [H05F](#))
 - H01L23/62 . . Protection against overvoltage, e.g. fuses, shunts
 - H01L23/64 . . Impedance arrangements
 - H01L23/64C . . . [N: Capacitive arrangements ([H01L23/495Q](#), [H01L23/64L](#), [H01L23/64R](#), [H01L23/66](#) take precedence; capacitive effects between wiring layers on the semiconductor body [H01L23/522C](#))]
 - H01L23/64L . . . [N: Inductive arrangements ([H01L23/64R](#), [H01L23/66](#) take precedence)]
 - H01L23/64R . . . [N: Resistive arrangements ([H01L23/66](#), [H01L23/62](#) take precedence)]
 - H01L23/66 . . . High-frequency adaptations

[N: **Notes**

[N1207]When classifying in group [H01L23/66](#), details are to be further indexed by using the ICO codes chosen from [T01L223/66](#) and subgroups]

H01L24/00

[N: Arrangements for connecting or disconnecting semiconductor or solid-state bodies; Methods or apparatus related thereto] [N1107] [C1207]

[N: **WARNING**

[N1108]Not complete, see provisionally also [H01L21/48C7](#), [H01L21/58](#), [H01L23/48](#), [H01L23/482](#), [H01L23/485](#), [H01L23/488](#)]

[N: **Notes**

[N1108] 1. This group does not cover: - details of semiconductor bodies or of electrodes of devices provided for in group [H01L29/00](#), which details are covered by that group; - details peculiar to devices provided for in a single main group of groups [H01L31/00](#) to [H01L51/00](#), which details are covered by those groups. - printed circuits, which are covered by groups [H05K1/00](#) to [H05K1/18F](#); - apparatus or manufacturing processes for printed circuits, which are covered by groups [H05K3/00](#) to [H05K3/46D](#); - manufacture or treatment of parts, which are covered by group [H01L21/48](#) and subgroups except [H01L21/48C7](#) to [H01L21/48C7M](#); - assemblies of semiconductor devices, which are covered by groups [H01L21/50](#) to [H01L21/56T](#); - applying interconnections to be used for carrying current between separate components within a device, which is covered by group [H01L21/768](#) and subgroups; - containers or seals, which are covered by groups [H01L23/02](#) to [H01L23/10](#); - mountings, which are covered by groups [H01L23/12](#) to [H01L23/15](#) and subgroups; - arrangements for cooling, heating, ventilating or temperature compensation, which are covered by groups [H01L23/34](#) to [H01L23/473J](#); - arrangements for conducting electric current, which are covered by groups [H01L23/48](#) to [H01L23/50](#), and by groups [H01L23/52](#) to [H01L23/538V](#); - structural electrical

ngements, which are covered by groups [H01L23/58](#) to [H01L23/66](#); - assemblies of semiconductor or other solid state devices, which are covered by groups [H01L25/00](#) to [H01L25/18](#). 2. In this group the following indexing codes are used : [T01L24/00](#) [T01L224/00](#), [T01L924/00](#), and subgroups thereof

]

- [H01L24/01](#) . [N: Means for bonding being attached to, or being formed on, the surface to be connected, e.g. chip-to-package, die-attach, "first-level" interconnects; Manufacturing methods related thereto] [N1108] [M1208]
- [N: **WARNING**
[N1108] 1. Not complete, see provisionally also [H01L23/482](#), [H01L23/485](#) and subgroups 2. Pending reorganisation subgroups of this group are not complete; see also this group and the other subgroups
]
- [H01L24/02](#) . . [N: Bonding areas (on insulating substrates, e.g. chip carriers, [H01L23/498C4](#), [H01L23/498G](#), [H01L23/538V](#)); Manufacturing methods related thereto] [N1108]
- [N: **WARNING**
[N1108]1. Pending reorganisation see provisionally also [H01L24/10](#) for Under Bump Metallization [UBM] 2. Pending reorganisation, subgroups of this group are not complete; see also this group
]
- [H01L24/03](#) . . . [N: Manufacturing methods] [N1108]
- [H01L24/04](#) . . . [N: Structure, shape, material or disposition of the bonding areas prior to the connecting process] [N1108] [C1207]
- [H01L24/05](#) [N: of an individual bonding area] [N1108]
- [H01L24/06](#) [N: of a plurality of bonding areas] [N1108]
- [H01L24/07](#) . . . [N: Structure, shape, material or disposition of the bonding areas after the connecting process] [N1204]
- [H01L24/08](#) [N: of an individual bonding area] [N1204]
- [H01L24/09](#) [N: of a plurality of bonding areas] [N1204]
- [H01L24/10](#) . . [N: Bump connectors (bumps on insulating substrates, e.g. chip carriers, [H01L23/498C4](#)); Manufacturing methods related thereto] [N1108]
- [N: **WARNING**
[N1108]Pending reorganisation, subgroups of this group are not complete; see also this group
]
- [H01L24/11](#) . . . [N: Manufacturing methods (for bumps on insulating substrates [H01L21/48C4C](#))] [N1108]
- [H01L24/12](#) . . . [N: Structure, shape, material or disposition of the bump connectors prior to the connecting process] [N1108]
- [H01L24/13](#) [N: of an individual bump connector] [N1108]
- [H01L24/14](#) [N: of a plurality of bump connectors] [N1108]
- [H01L24/15](#) . . . [N: Structure, shape, material or disposition of the bump connectors after the connecting process] [N1108]
- [H01L24/16](#) [N: of an individual bump connector] [N1108]
- [H01L24/17](#) [N: of a plurality of bump connectors] [N1108]

- H01L24/18 . . [N: High density interconnect [HDI] connectors; Manufacturing methods related thereto (interconnection structure between a plurality of semiconductor chips [H01L23/538V](#))] [N1108]
- [N: **WARNING**
[N1108] 1. Pending reorganisation, see provisionally also [H01L24/82](#) 2. Pending reorganisation, subgroups of this group are not complete; see also this group
]
- H01L24/19 . . . [N: Manufacturing methods of high density interconnect preforms] [N1108]
- H01L24/20 . . . [N: Structure, shape, material or disposition of high density interconnect preforms] [N1108]
- H01L24/23 . . . [N: Structure, shape, material or disposition of the high density interconnect connectors after the connecting process] [N1108]
- H01L24/24 [N: of an individual high density interconnect connector] [N1108]
- H01L24/25 [N: of a plurality of high density interconnect connectors] [N1108]
- H01L24/26 . . [N: Layer connectors, e.g. plate connectors, solder or adhesive layers; Manufacturing methods related thereto] [N1108]
- H01L24/27 . . . [N: Manufacturing methods] [N1108]
- H01L24/28 . . . [N: Structure, shape, material or disposition of the layer connectors prior to the connecting process] [N1108]
- H01L24/29 [N: of an individual layer connector] [N1108]
- H01L24/30 [N: of a plurality of layer connectors] [N1108]
- H01L24/31 . . . [N: Structure, shape, material or disposition of the layer connectors after the connecting process] [N1108]
- H01L24/32 [N: of an individual layer connector] [N1108]
- H01L24/33 [N: of a plurality of layer connectors] [N1108]
- H01L24/34 . . [N: Strap connectors, e.g. copper straps for grounding power devices; Manufacturing methods related thereto] [N1108]
- [N: **WARNING**
[N1108] 1. Pending reorganisation see provisionally also [H01L24/01](#), [H01L24/42](#), [H01L24/85](#) 2. Pending reorganisation, subgroups of this group are not complete; see also this group
]
- H01L24/35 . . . [N: Manufacturing methods] [N1108]
- H01L24/36 . . . [N: Structure, shape, material or disposition of the strap connectors prior to the connecting process] [N1108]
- H01L24/37 [N: of an individual strap connector] [N1108]
- H01L24/38 [N: of a plurality of strap connectors] [N1108]
- H01L24/39 . . . [N: Structure, shape, material or disposition of the strap connectors after the connecting process] [N1108]
- H01L24/40 [N: of an individual strap connector] [N1108]
- H01L24/41 [N: of a plurality of strap connectors] [N1108]
- H01L24/42 . . [N: Wire connectors; Manufacturing methods related thereto] [N1108]
- [N: **WARNING**
[N1108] Pending reorganisation documents in this group are being continuously reclassified to its subgroups
]
- H01L24/43 . . . [N: Manufacturing methods] [N1108]

- [N: **WARNING**
[N1108] Pending reorganisation see provisionally also [H01L21/48C7](#) and subgroups, [H01L24/42](#), [H01L24/85](#)
]
- H01L24/44 . . . [N: Structure, shape, material or disposition of the wire connectors prior to the connecting process] [N1108]
- [N: **WARNING**
[N1108] Pending reorganisation see provisionally also [H01L24/42](#), [H01L24/85](#)
]
- H01L24/45 [N: of an individual wire connector] [N1108]
- H01L24/46 [N: of a plurality of wire connectors] [N1108]
- H01L24/47 . . . [N: Structure, shape, material or disposition of the wire connectors after the connecting process] [N1108]
- [N: **WARNING**
[N1108] Pending reorganisation see provisionally also [H01L24/42](#), [H01L24/85](#)
]
- H01L24/48 [N: of an individual wire connector] [N1108]
- [N: **WARNING**
[N1108] Pending reorganisation see provisionally also [H01L24/42](#), [H01L24/85](#)
]
- H01L24/49 [N: of a plurality of wire connectors] [N1108]
- [N: **WARNING**
[N1108] Pending reorganisation see provisionally also [H01L24/42](#), [H01L24/85](#)
]
- H01L24/50 . . [N: Tape automated bonding [TAB] connectors, i.e. film carriers; Manufacturing methods related thereto (thin flexible metallic tape with or without a film carrier [H01L23/495J](#), flexible insulating substrates [H01L23/498J](#), [H01L23/538J](#))] [N1108]
- [N: **WARNING**
[N1108] Pending reorganisation see provisionally also [H01L24/86](#)
]
- H01L24/63 . . [N: Connectors not provided for in any of the groups [H01L24/10](#) to [H01L24/50](#) and subgroups; Manufacturing methods related thereto] [N1108]
- H01L24/64 . . . [N: Manufacturing methods] [N1107]
- H01L24/65 . . . [N: Structure, shape, material or disposition of the connectors prior to the connecting process] [N1108]
- H01L24/66 [N: of an individual connector] [N1108]
- H01L24/67 [N: of a plurality of connectors] [N1108]
- H01L24/68 . . . [N: Structure, shape, material or disposition of the connectors after the connecting process] [N1108]
- H01L24/69 [N: of an individual connector] [N1108]
- H01L24/70 [N: of a plurality of connectors] [N1108]
- H01L24/71 . [N: Means for bonding not being attached to, or not being formed on, the surface to be connected (holders for supporting the complete device in operation [H01L23/32](#))] [N1108] [M1208]

- H01L24/72 . . [N: Detachable connecting means consisting of mechanical auxiliary parts connecting the device, e.g. pressure contacts using springs or clips] [N1108]
- H01L24/73 . [N: Means for bonding being of different types provided for in two or more of groups [H01L24/10](#), [H01L24/18](#), [H01L24/26](#), [H01L24/34](#), [H01L24/42](#), [H01L24/50](#), [H01L24/63](#), [H01L24/71](#)] [N1108]
- H01L24/74 . [N: Apparatus for manufacturing arrangements for connecting or disconnecting semiconductor or solid-state bodies] [N1204]
- H01L24/741 . . [N: Apparatus for manufacturing means for bonding, e.g. connectors] [N1204]
- H01L24/742 . . . [N: Apparatus for manufacturing bump connectors] [N1204]
- H01L24/743 . . . [N: Apparatus for manufacturing layer connectors] [N1204]
- H01L24/744 . . . [N: Apparatus for manufacturing strap connectors] [N1204]
- H01L24/745 . . . [N: Apparatus for manufacturing wire connectors] [N1204]
- H01L24/75 . . [N: Apparatus for connecting with bump connectors or layer connectors] [N1204]
- H01L24/76 . . [N: Apparatus for connecting with build-up interconnects] [N1204]
- H01L24/77 . . [N: Apparatus for connecting with strap connectors] [N1204]
- H01L24/78 . . [N: Apparatus for connecting with wire connectors] [N1204]
- H01L24/79 . . [N: Apparatus for Tape Automated Bonding [TAB]] [N1204]
- H01L24/799 . . [N: Apparatus for disconnecting] [N1204]
- H01L24/80 . [N: Methods for connecting semiconductor or other solid state bodies using means for bonding being attached to, or being formed on, the surface to be connected] [N1108] [M1208]

[N: **WARNING**
[N1108]1. Pending reorganisation see provisionally also [H01L21/60](#) 2. Subgroups of this group are not complete; see also this group and the other subgroups
]
- H01L24/81 . . [N: using a bump connector] [N1108]

[N: **WARNING**
[N1108]Pending reorganisation see provisionally also [H01L21/60C4](#)
]
- H01L24/82 . . [N: by forming build-up interconnects at chip-level, e.g. for high density interconnects [HDI] (interconnection structure between a plurality of semiconductor chips [H01L23/538V](#))] [N1108]
- H01L24/83 . . [N: using a layer connector] [N1108]

[N: **WARNING**
[N1108]Pending reorganisation see provisionally also [H01L21/60C2](#)
]
- H01L24/84 . . [N: using a strap connector] [N1108]

[N: **WARNING**
[N1108] Pending reorganisation see provisionally also [H01L24/85](#)
]
- H01L24/85 . . [N: using a wire connector (wire bonding in general [B23K20/00D2](#))] [N1108]
- H01L24/86 . . [N: using tape automated bonding [TAB]] [N1108]
- H01L24/89 . . [N: using at least one connector not provided for in any of the groups [H01L24/81](#) to [H01L24/86](#)] [N1108]

- H01L24/90
 - [N: Methods for connecting semiconductor or solid state bodies using means for bonding not being attached to, or not being formed on, the body surface to be connected, e.g. pressure contacts using springs or clips] [N1108]
 - [N: **WARNING**
[N1108] Pending reorganisation see provisionally also [H01L21/60E](#)
]
- H01L24/91
 - [N: Methods for connecting semiconductor or solid state bodies including different methods provided for in two or more of groups [H01L24/80](#) to [H01L24/90](#)] [N1108]
- H01L24/92
 - . [N: Specific sequence of method steps] [N1108]
- H01L24/93
 - [N: Batch processes] [N1108]
 - [N: **WARNING**
[N1108] Pending reorganisation see provisionally also [H01L24/80](#) and subgroups and [H01L24/90](#)
]
- H01L24/94
 - . [N: at wafer-level, i.e. with connecting carried out on a wafer comprising a plurality of undiced individual devices] [N1108]
- H01L24/95
 - . [N: at chip-level, i.e. with connecting carried out on a plurality of singulated devices, i.e. on diced chips] [N1108]
- H01L24/96
 - . . [N: the devices being encapsulated in a common layer, e.g. neo-wafer or pseudo-wafer, said common layer being separable into individual assemblies after connecting] [N1108]
- H01L24/97
 - . . [N: the devices being connected to a common substrate, e.g. interposer, said common substrate being separable into individual assemblies after connecting] [N1108]
- H01L24/98
 - [N: Methods for disconnecting semiconductor or solid-state bodies] [N1108]
- H01L25/00**

Assemblies consisting of a plurality of individual semiconductor or other solid state devices [N: ; Multistep manufacturing processes thereof] ([N: lead frames with assemblies of semiconductor devices thereon [H01L23/495L](#); assembling semiconductor devices using processes or apparatus not provided for in a single one of the subgroups [H01L21/06](#) to [H01L21/326](#), e.g. sealing of a cap to a base of a container, [H01L21/50](#); devices consisting of a plurality of solid state components formed in or on a common substrate [H01L27/00](#); assemblies of photoelectric cells [H01L31/042](#), [N: [H01G9/20](#)]; generators using solar cells or solar panels [N: [H02S](#)]; details of complete circuit assemblies for which provision exists in another subclass, e.g. details of television receivers, see the relevant subclass, e.g. [H04N](#); details of assemblies of electrical components in general [H05K](#)) [C1204]
- H01L25/03
 - all the devices being of a type provided for in the same subgroup of groups [H01L27/00](#) to [H01L51/00](#), e.g. assemblies of rectifier diodes [C9907]
- H01L25/04
 - . the devices not having separate containers
- H01L25/04C
 - . . [N: the devices being of a type provided for in group [H01L31/00](#)]
- H01L25/04C2
 - . . . [N: the devices being arranged next to each other ([solar cells](#) [H01L31/042](#))]
- H01L25/04C4
 - [N: Stacked arrangements of devices]
- H01L25/04C4C
 - [N: the devices being solar cells]
- H01L25/04E
 - . . . [N: the devices being of a type provided for in group [H01L51/00](#)] [N0006]

- H01L25/04E2 [N: the devices being of a type provided for in group [H01L51/42](#), e.g. photovoltaic modules based on organic solar cells] [N0006] [M1107]
- H01L25/04E4 [N: the devices being of a type provided for in group [H01L51/50](#), e.g. assembly of organic light emitting devices] [N1108]
- H01L25/065 . . . the devices being of a type provided for in group [H01L27/00](#)
- [N: **Note**
Group [H01L25/065M](#) takes precedence over groups [H01L25/065N](#) and [H01L25/065S](#)
]
- H01L25/065M [N: the devices being arranged next and on each other, i.e. mixed assemblies]
- H01L25/065N [N: the devices being arranged next to each other]
- H01L25/065S [N: Stacked arrangements of devices]
- H01L25/07 . . . the devices being of a type provided for in group [H01L29/00](#)
- [N: **Note**
Group [H01L25/07M](#) takes precedence over groups [H01L25/07N](#) to [H01L25/07S](#)
]
- H01L25/07M [N: the devices being arranged next and on each other, i.e. mixed assemblies]
- H01L25/07N [N: the devices being arranged next to each other]
- H01L25/07R [N: Apertured devices mounted on one or more rods passed through the apertures]
- H01L25/07S [N: Stacked arrangements of non-apertured devices]
- H01L25/075 . . . the devices being of a type provided for in group [H01L33/00](#)
- H01L25/075N [N: the devices being arranged next to each other]
- H01L25/075S [N: Stacked arrangements of devices]
- H01L25/10 . . . the devices having separate containers
- H01L25/10J . . . [N: the devices being of a type provided for in group [H01L27/00](#)]
- [N: **Notes**
[N1207]When classifying in group [H01L25/10J](#), details of the assemblies are to be further indexed by using the ICO codes chosen from [T01L225/10J](#) and subgroups
]
- H01L25/11 . . . the devices being of a type provided for in group [H01L29/00](#)
- [N: **Note**
Group [H01L25/11M](#) takes precedence over groups [H01L25/11N](#) and [H01L25/11S](#)
]
- H01L25/11M [N: Mixed assemblies]
- H01L25/11N [N: the devices being arranged next to each other]
- H01L25/11S [N: Stacked arrangements of devices]
- H01L25/13 . . . the devices being of a type provided for in group [H01L33/00](#)
- H01L25/16 . . . the devices being of types provided for in two or more different main groups of [H01L27/00](#) to [H01L49/00](#) [N: and [H01L51/00](#)], e.g. forming hybrid circuits [N: (interconnections for hybrid circuits [H01L23/538V](#))] [C9907]

- H01L25/16F . . [N: the devices being mounted on two or more different substrates] [N9506]
- H01L25/16H . . [N: Containers] [N9506]
- H01L25/16L . . [N: comprising optoelectronic devices, e.g. LED, photodiodes]
- H01L25/18 . the devices being of types provided for in two or more different subgroups of the same main group of groups H01L27/00 to H01L51/00 [N: (comprising devices provided for in H01L27/144 and subgroups, see H01L27/144 and subgroups)] [C0605]
- H01L25/50 . [N: Multistep manufacturing processes of assemblies consisting of devices, each device being of a type provided for in group H01L27/00 or H01L29/00 (H01L21/50 takes precedence)] [N1204]

H01L27/00

Devices consisting of a plurality of semiconductor or other solid state components formed in or on a common substrate (processes or apparatus specially adapted for the manufacture or treatment thereof or of parts thereof [H01L21/70](#), [H01L31/00](#) to [H01L51/00](#); details thereof [H01L23/00](#), [H01L29/00](#) to [H01L51/00](#); assemblies consisting of a plurality of individual solid state devices [H01L25/00](#); assemblies of electrical components in general H05K) [C0308]

Note

In this group, in the absence of an indication to the contrary, classification is made in the last appropriate place. [C0308]

- H01L27/01 . comprising only passive thin-film or thick-film elements formed on a common insulating substrate [N: (passive two-terminal components without a potential-jump or surface barrier for integrated circuits, details thereof and multistep manufacturing processes therefor [H01L28/00](#))] [C1112]

Note

In groups [H01L27/01](#) to [H01L27/26](#), in the absence of an indication to the contrary, classification is made in the last appropriate place.

- H01L27/01B . . [N: Thick-film circuits]
- H01L27/01C . . [N: Thin-film circuits]
- H01L27/02 . including semiconductor components specially adapted for rectifying, oscillating, amplifying or switching and having at least one potential-jump barrier or surface barrier; including integrated passive circuit elements with at least one potential-jump barrier or surface barrier [C0308]
- H01L27/02B . . [N: Particular design considerations for integrated circuits]
- H01L27/02B2 . . . [N: Geometrical layout of the components, e.g. computer aided design; custom LSI, semi-custom LSI, standard cell technique]
- H01L27/02B2B [N: adapted for requirements of temperature (cooling arrangements per se [H01L23/34](#))]
- H01L27/02B3 [N: for internal polarisation, e.g. I2L]
- H01L27/02B3B [N: of field effect structures]
- H01L27/02B3B2 [N: Charge pumping, substrate bias generation structures (circuits [G05F3/20S](#))]
- H01L27/02B3B3 [N: Charge injection in static induction transistor logic structures, i.e. SITL (circuits [H03K19/091B](#))]
- H01L27/02B3C [N: of bipolar structures]
- H01L27/02B3C2 [N: Integrated injection logic structures, i.e. I2L (circuits [H03K19/091](#))]

H01L27/02B3C2B	. . . . .	[N: using vertical injector structures]
H01L27/02B3C2C	. . . . .	[N: using field effect injector structures]
H01L27/02B3C2D	. . . . .	[N: I2L structures integrated in combination with analog structures]
H01L27/02B4	. . . . .	[N: for electrical or thermal protection, e.g. electrostatic discharge [ESD] protection (emergency protective circuit arrangements H02H; circuit arrangements for protecting electronic switches H03K17/08; circuit arrangements for protecting logic circuits H03K19/003)] [C1109]
H01L27/02B4F	. . . . .	[N: for MOS devices]
H01L27/02B4F2	. . . . .	[N: using diodes as protective elements (diode connected field effect transistors H01L27/02B4F6; diode connected bipolar transistors H01L27/02B4F4)] [C1109]
H01L27/02B4F4	. . . . .	[N: using bipolar transistors as protective elements] [C1109]
H01L27/02B4F4S	. . . . .	[N: including a PNP transistor and a NPN transistor, wherein each of said transistors has its base coupled to the collector of the other transistor, e.g. silicon controlled rectifier [SCR] devices] [N1109]
H01L27/02B4F6	. . . . .	[N: using field effect transistors as protective elements] [C1109]
H01L27/02B4F6B	. . . . .	[N: specially adapted to provide an electrical current path other than the field effect induced current path] [N1109]
H01L27/02B4F6B2	. . . . .	{7 dots} [N: involving a parasitic bipolar transistor triggered by the electrical biasing of the gate electrode of the field effect transistor, e.g. gate coupled transistors] [N1109]
H01L27/02B4F6B4	. . . . .	{7 dots} [N: involving a parasitic bipolar transistor triggered by the local electrical biasing of the layer acting as base of said parasitic bipolar transistor] [N1109]
H01L27/02B4F6D	. . . . .	[N: field effect transistors in a "Darlington-like" configuration] [N1109]
H01L27/02B4F6P	. . . . .	[N: bias arrangements for gate electrode of field effect transistors, e.g. RC networks, voltage partitioning circuits (H01L27/02B4F6D takes precedence)] [N1109]
H01L27/02B4F8	. . . . .	[N: using passive elements as protective elements, e.g. resistors, capacitors, inductors, spark-gaps] [C1109]
H01L27/02B4F14	. . . . .	[N: using a specific configuration of the conducting means connecting the protective devices, e.g. ESD buses] [N1109]
H01L27/02B4F18	. . . . .	[N: involving a specific disposition of the protective devices] [N1109]
H01L27/04	. . . . .	the substrate being a semiconductor body
H01L27/06	. . . . .	including a plurality of individual components in a non-repetitive configuration
H01L27/06C	. . . . .	[N: integrated circuits made of compound material, e.g. AlIIBV]
H01L27/06D	. . . . .	[N: integrated circuits having a two-dimensional layout of components without a common active region]
H01L27/06D4	. . . . .	[N: comprising components of the field-effect type (H01L27/02B4F takes precedence)]
H01L27/06D4T	. . . . .	[N: in combination with bipolar transistors]
H01L27/06D4V	. . . . .	[N: in combination with diodes, or resistors, or capacitors]
H01L27/06D4W	. . . . .	[N: in combination with bipolar transistors and diodes, or resistors, or capacitors]
H01L27/06D6	. . . . .	[N: without components of the field effect type]
H01L27/06D6T	. . . . .	[N: Bipolar transistors in combination with diodes, or capacitors, or resistors, e.g. vertical bipolar transistor and bipolar lateral transistor and resistor]

H01L27/06D6T2	. . . . .	{7 dots} [N: Vertical bipolar transistor in combination with diodes, or capacitors, or resistors]
H01L27/06D6T2B	. . . . .	{8 dots} [N: Vertical bipolar transistor in combination with resistors or capacitors]
H01L27/06D6T2D	. . . . .	{8 dots} [N: Vertical bipolar transistor in combination with diodes]
H01L27/06D6T4	. . . . .	{7 dots} [N: Lateral bipolar transistor in combination with diodes, or capacitors, or resistors]
H01L27/06D6V	. . . . .	[N: comprising combinations of diodes, or capacitors or resistors]
H01L27/06D6V2	. . . . .	{7 dots} [N: comprising combinations of capacitors and resistors]
H01L27/06E	. . . . .	[N: Integrated circuits having a three-dimensional layout]
H01L27/06E2	. . . . .	[N: comprising components formed on opposite sides of a semiconductor substrate]
H01L27/07	. . . . .	the components having an active region in common
H01L27/07F	. . . . .	[N: comprising components of the field effect type]
H01L27/07F2	. . . . .	[N: in combination with bipolar transistors and diodes, or capacitors, or resistors]
H01L27/07F2B	. . . . .	{7 dots} [N: in combination with vertical bipolar transistors and diodes, or capacitors, or resistors]
H01L27/07F2L	. . . . .	{7 dots} [N: in combination with lateral bipolar transistors and diodes, or capacitors, or resistors]
H01L27/07F4	. . . . .	[N: in combination with diodes, or capacitors or resistors]
H01L27/07F4C	. . . . .	{7 dots} [N: in combination with capacitors only]
H01L27/07F4R	. . . . .	{7 dots} [N: in combination with resistors only]
H01L27/07T	. . . . .	[N: without components of the field effect type]
H01L27/07T2	. . . . .	[N: Bipolar transistors in combination with diodes, or capacitors, or resistors, e.g. lateral bipolar transistor, and vertical bipolar transistor and resistor]
H01L27/07T2C	. . . . .	{7 dots} [N: Vertical bipolar transistor in combination with diodes, or capacitors, or resistors]
H01L27/07T2C2	. . . . .	{8 dots} [N: Vertical bipolar transistor in combination with diodes only]
H01L27/07T2C2S	. . . . .	{9 dots} [N: with Schottky diodes only]
H01L27/07T2C4	. . . . .	{8 dots} [N: Vertical bipolar transistor in combination with resistors only]
H01L27/07T2C6	. . . . .	{8 dots} [N: Vertical bipolar transistor in combination with capacitors only]
H01L27/07T2L	. . . . .	{7 dots} [N: Lateral bipolar transistors in combination with diodes, or capacitors, or resistors]
H01L27/07T5	. . . . .	[N: comprising combinations of diodes or capacitors or resistors]
H01L27/07T5C	. . . . .	{7 dots} [N: Combinations of capacitors and resistors]
H01L27/08	. . . . .	including only semiconductor components of a single kind
H01L27/08B	. . . . .	[N: Resistors only]
H01L27/08C	. . . . .	[N: Capacitors only]
H01L27/08C2	. . . . .	[N: Varactor diodes]
H01L27/08C3	. . . . .	[N: MIS diodes]
H01L27/08D	. . . . .	[N: Diodes only]

H01L27/08U	. . . .	[N: Thyristors only]
H01L27/082	. . . .	including bipolar components only
H01L27/082L	. . . . .	[N: Combination of lateral and vertical transistors only]
H01L27/082V	. . . . .	[N: including vertical bipolar transistors only]
H01L27/082V2	. . . . .	[N: Combination of vertical direct transistors of the same conductivity type having different characteristics, (e.g. Darlington transistors)]
H01L27/082V4	. . . . .	[N: Combination of vertical complementary transistors]
H01L27/082V6	. . . . .	[N: Combination of direct and inverse vertical transistors]
H01L27/085	. . . . .	[N: including field-effect components only]
H01L27/088	. . . . .	the components being field-effect transistors with insulated gate
H01L27/088D	. . . . .	[N: Combination of depletion and enhancement field effect transistors]
H01L27/088F	. . . . .	[N: including transistors with a horizontal current flow in a vertical sidewall of a semiconductor body, e.g. FinFET, MuGFET] [N1009]
H01L27/092	. . . . .	Complementary MIS field-effect transistors
H01L27/092B	. . . . .	{7 dots} [N: Means for preventing a bipolar, e.g. thyristor, action between the different transistor regions, e.g. Latchup prevention]
H01L27/092D	. . . . .	{7 dots} [N: Combination of complementary transistors having a different structure, e.g. stacked CMOS, high-voltage and low-voltage CMOS]
H01L27/092F	. . . . .	{7 dots} [N: including transistors with a horizontal current flow in a vertical sidewall of a semiconductor body, e.g. FinFET, MuGFET] [N1009]
H01L27/092N	. . . . .	{7 dots} [N: comprising an N-well only in the substrate]
H01L27/092P	. . . . .	{7 dots} [N: comprising a P-well only in the substrate]
H01L27/092T	. . . . .	{7 dots} [N: comprising both N- and P- wells in the substrate, e.g. twin-tub]
H01L27/095	. . . . .	the components being Schottky barrier gate field-effect transistors
H01L27/098	. . . . .	the components being PN junction gate field-effect transistors
H01L27/10	. . . .	including a plurality of individual components in a repetitive configuration
H01L27/10C	. . . . .	[N: including resistors or capacitors only]
H01L27/102	. . . . .	including bipolar components
H01L27/102D	. . . . .	[N: including diodes only]
H01L27/102T	. . . . .	[N: including bipolar transistors]
H01L27/102T2	. . . . .	[N: Bipolar dynamic random access memory structures (circuits G11C11/24 , G11C11/34)]
H01L27/102T4	. . . . .	[N: Arrays of single bipolar transistors only, e.g. read only memory structures]
H01L27/102T5	. . . . .	[N: Static bipolar memory cell structures (circuits G11C11/40)]
H01L27/102T6	. . . . .	[N: Bipolar electrically programmable memory structures (using fuses H01L23/525)]
H01L27/102U	. . . . .	[N: Thyristors]
H01L27/102V	. . . . .	[N: Double base diodes]
H01L27/105	. . . . .	including field-effect components

[N: WARNING

[N1207]In this group and its subgroups classification is made in any

			appropriate place]
H01L27/105A	. . . . .	[N: Memory structures and multistep manufacturing processes therefor not provided for in groups H01L27/105B to H01L27/112] [N1204]	
H01L27/105B	. . . . .	[N: comprising charge coupled devices of the so-called bucket brigade type]	
H01L27/105C	. . . . .	[N: comprising charge coupled devices (CCD) or charge injection devices (CID)]	
H01L27/108	. . . . .	Dynamic random access memory structures (circuits G11C1/24, G11C11/34)	
		[N: Notes [N1104] In this group and its subgroups classification is made in any appropriate place]	
H01L27/108B	. . . . .	[N: comprising floating-body transistors, e.g. floating-body cells (floating-body transistors per se H01L29/78L)] [N1104]	
H01L27/108F	. . . . .	[N: with one-transistor one-capacitor memory cells] [C1104]	
H01L27/108F2	. . . . .	{7 dots} [N: the storage electrode stacked over transistor]	
H01L27/108F2B	. . . . .	{8 dots} [N: with bit line higher than capacitor] [N0201]	
H01L27/108F2C	. . . . .	{8 dots} [N: with capacitor higher than bit line level] [N0201]	
H01L27/108F2M	. . . . .	{8 dots} [N: the storage electrode having multiple wings]	
H01L27/108F4	. . . . .	{7 dots} [N: the capacitor extending under transfer transistor area]	
H01L27/108F6	. . . . .	{7 dots} [N: the transistor having a trench structure in the substrate] [C1104]	
H01L27/108F7	. . . . .	{7 dots} [N: the transistor being of the FinFET type] [N1104]	
		[N: WARNING [N1104] not complete pending completion of reclassification; see also H01L27/108F6]	
H01L27/108F8	. . . . .	{7 dots} [N: the capacitor being in a substrate trench] [C1104]	
H01L27/108F8E	. . . . .	{8 dots} [N: the capacitor extending under or around transfer transistor area]	
H01L27/108F8S	. . . . .	{8 dots} [N: having storage electrode extension stacked over transistor]	
H01L27/108F10	. . . . .	{7 dots} [N: the capacitor and the transistor being in one trench] [C1104]	
H01L27/108F10V	. . . . .	{8 dots} [N: the transistor being vertical]	
H01L27/108M	. . . . .	[N: Multistep manufacturing methods] [N1104]	
H01L27/108M4	. . . . .	{7 dots} [N: for structures comprising one transistor one-capacitor memory cells] [N1104]	
		[N: WARNING [N1104] not complete pending completion of reclassification; see also H01L27/108M]	
H01L27/108M4B	. . . . .	{8 dots} [N: with at least one step of making the capacitor or connections thereto (making a capacitor for integrated circuits)]	

		H01L28/40 , H01L29/66M6D6] [N1104] [C1203]
H01L27/108M4B2	. . . . .	{9 dots} [N: the capacitor extending over the access transistor] [N1104]
H01L27/108M4B2C	. . . . .	{10 dots} [N: with at least one step of making a connection between transistor and capacitor, e.g. plug] [N1104]
H01L27/108M4B4	. . . . .	{9 dots} [N: the capacitor extending under the access transistor area] [N1104]
H01L27/108M4B6	. . . . .	{9 dots} [N: the capacitor being in a substrate trench] [N1104]
H01L27/108M4B6B	. . . . .	{10 dots} [N: in combination with a vertical transistor] [N1104]
H01L27/108M4B6C	. . . . .	{10 dots} [N: with at least one step of making a connection between transistor and capacitor, e.g. buried strap] [N1104]
H01L27/108M4B6T	. . . . .	{10 dots} [N: with at least one step of making the trench] [N1104] [C1112]
H01L27/108M4C	. . . . .	{8 dots} [N: with at least one step of making the transistor (making the transistor per se H01L29/66M6T6)] [N1104] [C1203]
H01L27/108M4C2	. . . . .	{9 dots} [N: the transistor having a trench structure in the substrate (vertical transistor in combination with a capacitor formed in a substrate trench H01L27/108M4B6B)] [N1104]
H01L27/108M4C4	. . . . .	{9 dots} [N: the transistor being of the FinFET type] [N1104]
		[N: WARNING [N1104] not complete pending completion of reclassification; see also H01L27/108M4C2]
H01L27/108M4D	. . . . .	{8 dots} [N: with at least one step of making a data line] [N1104]
H01L27/108M4D2	. . . . .	{9 dots} [N: with at least one step of making a bit line] [N1104]
H01L27/108M4D4	. . . . .	{9 dots} [N: with at least one step of making a bit line contact] [N1104]
H01L27/108M4D6	. . . . .	{9 dots} [N: with at least one step of making a word line] [N1104]
H01L27/108M8	. . . . .	{7 dots} [N: with simultaneous manufacture of periphery and memory cells] [N1104]
H01L27/108P	. . . . .	[N: Peripheral structures] [N0201]
H01L27/11	. . . . .	Static random access memory structures [N: and multistep manufacturing processes therefor (circuits G11C11/40)] [C1207]
H01L27/11F	. . . . .	[N: the load element being a MOSFET transistor]
H01L27/11F2	. . . . .	{7 dots} [N: the load element being a thin film transistor]
H01L27/11R	. . . . .	[N: the load element being a resistor (resistors for integrated circuits H01L28/20 , H01L29/8605)] [C1112]
H01L27/11U	. . . . .	[N: Peripheral circuit region] [N1204]
		[N: WARNING not complete, pending reorganisation, see provisionally also H01L27/105]

H01L27/112	. . . . .	Read-only memory structures [N: [ROM] and multistep manufacturing processes therefor] [C1207]
H01L27/112P	. . . . .	[N: Programmable ROM [PROM], e.g. memory cells comprising a transistor and a fuse or an antifuse] [N1204]
H01L27/112R	. . . . .	[N: ROM only] [N1204]
H01L27/112R2	. . . . .	{7 dots} [N: with source and drain on the same level, e.g. lateral transistors] [N1204]
H01L27/112R2B	. . . . .	{8 dots} [N: Source or drain contact programmed] [N1204]
H01L27/112R2C	. . . . .	{8 dots} [N: Gate programmed, e.g. different gate material or no gate] [N1204]
H01L27/112R2C4	. . . . .	{9 dots} [N: Gate contact programmed] [N1204]
H01L27/112R2C6	. . . . .	{9 dots} [N: Gate dielectric programmed, e.g. different thickness] [N1204]
H01L27/112R2D	. . . . .	{8 dots} [N: Doping programmed, e.g. mask ROM] [N1204]
H01L27/112R2D4	. . . . .	{9 dots} [N: Entire channel doping programmed] [N1204]
H01L27/112R2D6	. . . . .	{9 dots} [N: Source or drain doping programmed] [N1204]
H01L27/112R4	. . . . .	{7 dots} [N: with source and drain on different levels, e.g. vertical channel] [N1204]
H01L27/112R6	. . . . .	{7 dots} [N: with transistors on different levels, e.g. 3D ROM] [N1204]
H01L27/112U	. . . . .	[N: Peripheral circuit regions] [N1204]
		[N: WARNING not complete pending reorganisation, see provisionally also H01L27/105]
H01L27/112U4	. . . . .	{7 dots} [N: of memory structures of the ROM-only type] [N1204]
H01L27/115	. . . . .	Electrically programmable read-only memories [N: and multistep manufacturing processes therefor] [C1207]
H01L27/115C	. . . . .	{7 dots} [N: with ferroelectric memory capacitor] [N0902]
H01L27/115C2	. . . . .	{8 dots} [N: Top-view layout] [N0909]
		[N: WARNING [N0909] Not complete, see H01L27/115C]
H01L27/115C4	. . . . .	{8 dots} [N: Memory core region] [N0909]
H01L27/115C6	. . . . .	{8 dots} [N: Peripheral circuit region] [N0909]
H01L27/115C8	. . . . .	{8 dots} [N: Boundary region between core and peripheral circuit region] [N0909]
		[N: WARNING [N0909] Not complete, see H01L27/115C]
H01L27/115C10	. . . . .	{8 dots} [N: Three-dimensional arrangements, e.g. cells on different height levels] [N0909]
		[N: WARNING [N0909] Not complete, see H01L27/115C]
H01L27/115F	. . . . .	{7 dots} [N: with floating gate] [N0911]

[N: **WARNING** [N0911]

Group [H01L27/115F](#) and subgroups are not complete pending reorganisation. See also [H01L27/115](#)

]

H01L27/115F2	. . . . .	{8 dots} [N: Top-view layout] [N0911]
H01L27/115F4	. . . . .	{8 dots} [N: Memory core region core region (three-dimensional arrangements H01L27/115F10)] [N0911] [C1207]
H01L27/115F4N	. . . . .	{9 dots} [N: with at least one cell select transistor, e.g. NAND] [N1204]
H01L27/115F6	. . . . .	{8 dots} [N: Peripheral circuit region] [N0911]
H01L27/115F6N	. . . . .	{9 dots} [N: of memory regions comprising at least one cell select transistor, e.g. NAND] [N1204]
H01L27/115F6P	. . . . .	{9 dots} [N: Simultaneous fabrication of periphery and memory cells] [N1204]
H01L27/115F6P1	. . . . .	{10 dots} [N: including only one type of peripheral transistor] [N1204]
H01L27/115F6P1C	. . . . .	{11 dots} [N: Control gate layer used for the peripheral transistor] [N1204]
H01L27/115F6P1D	. . . . .	{11 dots} [N: Intergate dielectric layer used for the peripheral transistor] [N1204]
H01L27/115F6P1F	. . . . .	{11 dots} [N: Floating-gate layer used for the peripheral transistor] [N1204]
H01L27/115F6P1G	. . . . .	{11 dots} [N: Tunnel dielectric layer used for the peripheral transistor] [N1204]
H01L27/115F6P2	. . . . .	{10 dots} [N: including different types of peripheral transistors] [N1204]
H01L27/115F8	. . . . .	{8 dots} [N: Boundary region between core and peripheral circuit regions] [N0911]
H01L27/115F10	. . . . .	{8 dots} [N: Three-dimensional arrangements, e.g. cells on different height levels] [N0911]
H01L27/115F10C	. . . . .	{9 dots} [N: with source and drain on different levels, e.g. with sloping channel] [N1204]
H01L27/115F10C2	. . . . .	{10 dots} [N: the channel comprising at least one vertical portion, e.g. U-shaped channel] [N1204]

[N: **WARNING**

not complete pending reorganisation, see provisionally also [H01L27/115F10](#)

]

H01L27/115F12	. . . . .	{8 dots} [N: the control gate being a doped region, e.g. single-poly memory cells] [N1204]
H01L27/115F16	. . . . .	{8 dots} N: the floating gate being an electrode shared by a plurality of components] [N1204]
H01L27/115G	. . . . .	{7 dots} [N: with charge trapping gate insulator, e.g. MNOS, NROM] [N0909]
H01L27/115G2	. . . . .	{8 dots} [N: Top-view layout] [N0909]

[N: **WARNING**[N0909]

Not complete, see [H01L27/115](#)

]

H01L27/115G4	. . . . .	{8 dots} [N: Memory core region (three-dimensional arrangements H01L27/115G10)] [N0909] [C1207]
H01L27/115G4N	. . . . .	{9 dots} [N: with at least one cell select transistor, e.g. NAND] [N1204]
H01L27/115G6	. . . . .	{8 dots} [N: Peripheral circuit region] [N0909]
H01L27/115G8	. . . . .	{8 dots} [N: Boundary region between core and peripheral circuit region] [N0909]
		[N: WARNING [N0909] Not complete, see H01L27/115]
H01L27/115G10	. . . . .	{8 dots} [N: Three-dimensional arrangements, e.g. cells on different height levels] [N0909]
		[N: WARNING [N0909] Not complete, see H01L27/115]
H01L27/115G10C	. . . . .	{9 dots} [N: with source and drain on different levels, e.g. with sloping channel] [N1204]
H01L27/115G10C2	. . . . .	{10 dots} [N: the channel comprising at least one vertical portion, e.g. U-shaped channel] [N1204]
		[N: WARNING not complete pending reorganisation, see provisionally also H01L27/115G10]
H01L27/115K	. . . . .	{7 dots} [N: with gate electrode comprising a layer which is used for its ferroelectric memory properties, e.g. MFS (metal-ferroelectric-semiconductor), MFMIS (metal-ferroelectric-metal-insulator-semiconductor)] [N0902]
H01L27/115K2	. . . . .	{8 dots} [N: Top-view layout] [N0909]
		[N: WARNING [N0909] Not complete, see H01L27/115K]
H01L27/115K4	. . . . .	{8 dots} [N: Memory core region] [N0909]
H01L27/115K6	. . . . .	{8 dots} [N: Peripheral circuit region] [N0909]
H01L27/115K8	. . . . .	{8 dots} [N: Boundary region between core and peripheral circuit region] [N0909]
		[N: WARNING [N0909] Not complete, see H01L27/115K]
H01L27/115K10	. . . . .	{8 dots} [N: Three-dimensional arrangements, e.g. cells on different height levels] [N0909]
		[N: WARNING [N0909] Not complete, see H01L27/115K]
H01L27/118	. . . . .	Masterslice integrated circuits
H01L27/118B	. . . . .	[N: using bipolar technology]
H01L27/118G	. . . . .	[N: using field effect technology]

- H01L27/118G4 [N: CMOS gate arrays]
- H01L27/118M [N: using combined field effect/bipolar technology]
- H01L27/118P [N: Input and output buffer/driver structures]
- H01L27/12 . . the substrate being other than a semiconductor body, e.g. an insulating body
- H01L27/12B . . . [N: the substrate comprising an insulating body on a semiconductor body, e.g. SOI (three-dimensional layout H01L27/06E)]
- H01L27/12B2 [N: combined with devices in contact with the semiconductor body, i.e. bulk/SOI hybrid circuits] [N1009]
- H01L27/12B4 [N: combined with field-effect transistors with a horizontal current flow in a vertical sidewall of a semiconductor body, e.g. FinFET, MuGFET] [N1009]
- H01L27/12T . . . [N: comprising a plurality of TFTs formed on a non-semiconducting substrate, e.g. driving circuits for AMLCDs] [N1204]
- [N: **WARNING**
Subgroups of H01L27/12T are not complete, pending reorganisation; see provisionally also this group
]
- H01L27/12T2 [N: with a particular composition or structure of the substrate] [N1204]
- H01L27/12T4 [N: with a particular composition, shape or crystalline structure of the active layer] [N1204]
- H01L27/12T4K [N: with semiconductor materials not belonging to the group IV of the periodic table, e.g. InGaZnO] [N1204]
- H01L27/12T4P [N: with different crystal properties within a device or between different devices] [N1204]
- H01L27/12T4T [N: with different thicknesses of the active layer in different devices] [N1204]
- H01L27/12T6 [N: with a different composition, shape, layout or thickness of the gate insulator in different devices] [N1204]
- H01L27/12T8 [N: with a particular composition, shape or layout of the wiring layers specially adapted to the circuit arrangement, e.g. scanning lines in LCD pixel circuits (wiring structures per se H01L23/52)] [N1204]
- H01L27/12T8B [N: for preventing breakage, peeling or short circuiting] [N1204]
- H01L27/12T10 [N: with a particular composition or shape of the interlayer dielectric specially adapted to the circuit arrangement] [N1204]
- H01L27/12T12 [N: comprising TFTs having a different architecture, e.g. top- and bottom gate TFTs] [N1204]
- H01L27/12T14 [N: integrated with passive devices, e.g. auxiliary capacitors] [N1204]
- H01L27/12T30 [N: Multistep manufacturing methods] [N1204]
- H01L27/12T30A [N: with a particular formation, treatment or coating of the substrate] [N1204]
- H01L27/12T30A2 [N: the substrate on which the devices are formed not being the final device substrate, e.g. using a temporary substrate] [N1204]
- H01L27/12T30B [N: with a particular formation, treatment or patterning of the active layer specially adapted to the circuit arrangement] [N1204]
- H01L27/12T30B2 [N: using crystallisation of amorphous semiconductor or recrystallisation of crystalline semiconductor (crystallisation per se H01L21/02k4T8C)] [N1204]
- H01L27/12T30B2A {7 dots} [N: using a crystallisation promoting species, e.g. local introduction of Ni catalyst] [N1204]

- H01L27/12T30B2B {7 dots} [N: by using structural features to control crystal growth, e.g. placement of grain filters] [N1204]
- H01L27/12T30B2C {7 dots} [N: using control of the annealing or irradiation parameters, e.g. using different scanning direction or intensity for different transistors] [N1204]
- H01L27/12T30G [N: employing particular masking sequences or specially adapted masks, e.g. half-tone mask] [N1204]
- H01L27/12T30H [N: using liquid deposition, e.g. printing] [N1204]
- H01L27/12T30J [N: adapted to increase the uniformity of device parameters] [N1204]
- H01L27/13 combined with thin-film or thick-film passive components [N: (passive two-terminal components without a potential-jump or surface barrier for integrated circuits, details thereof and multistep manufacturing processes therefor [H01L28/00](#))] [C1112]
- H01L27/14 including semiconductor components sensitive to infra-red radiation, light, electromagnetic radiation of shorter wavelength, or corpuscular radiation and specially adapted either for the conversion of the energy of such radiation into electrical energy or for the control of electrical energy by such radiation ([radiation-sensitive components structurally associated with one or more electric light sources only H01L31/14](#); [couplings of light guides with optoelectronic elements G02B6/42](#)) [C0308]
- H01L27/142 Energy conversion devices
- H01L27/142B [N: comprising bypass diodes integrated or directly associated with the device, e.g. bypass diode integrated or formed in or on the same substrate as the solar cell] [N1204]
- H01L27/142R [N: in a repetitive configuration, e.g. planar multijunction solar cells]
- H01L27/142R2 [N: comprising only thin film solar cells deposited on a substrate, e.g. thin film (a-Si, CIS, CdTe) solar modules] [C1204]
- H01L27/142R2B [N: characterized by special patterning methods to connect the cells in a module, e.g. laser cutting of the conductive and/or active layers] [N1204]
- H01L27/142R2C [N: comprising particular structures for the electrical interconnection of adjacent solar cells in the module] [N1204]
- H01L27/142R2D [N: comprising specific means for obtaining a partial light transmission of the module, e.g. partially transparent thin film solar modules for windows] [N1204]
- H01L27/142R3 [N: comprising multiple vertical junction or V-groove junction solar cells formed in a semiconductor substrate]
- H01L27/144 Devices controlled by radiation
- H01L27/144B [N: with at least one potential jump or surface barrier]
- H01L27/144R [N: in a repetitive configuration]
- H01L27/146 Imager structures
- H01L27/146A [N: Structural or functional details thereof] [N9805]
- H01L27/146A2 [N: Special geometry or disposition of pixel-elements, address-lines or gate-electrodes] [N9805]
- H01L27/146A2B [N: Structural or functional details relating to the position of the pixel elements, e.g. smaller pixel elements in the center of the imager compared to pixel elements at the periphery] [N1108]
- H01L27/146A2P [N: Geometry of the photosensitive area] [N1108]
- H01L27/146A4 [N: Pixel-elements with integrated switching, control, storage or amplification elements ([scanning details of imagers H04N3/15](#); [circuitry of imagers H04N5/369](#))] [N9805] [C1108]

H01L27/146A4P	. . . . .	[N: characterised by the photosensitive area] [N1108]
H01L27/146A4T	. . . . .	[N: involving a transistor] [N1108]
H01L27/146A4T2	. . . . .	{7 dots} [N: having a special gate structure] [N1108]
H01L27/146A4T4	. . . . .	{7 dots} [N: characterised by the channel of the transistor, e.g. channel having a doping gradient] [N1108]
H01L27/146A6	. . . . .	[N: Containers] [N0605]
H01L27/146A8	. . . . .	[N: Coatings] [N0605]
H01L27/146A8C	. . . . .	[N: Colour filter arrangements] [N0605]
H01L27/146A8S	. . . . .	[N: Optical shielding] [N0605]
H01L27/146A10	. . . . .	[N: Optical elements or arrangements associated with the device] [N0605]
H01L27/146A10M	. . . . .	[N: Microlenses] [N0605]
H01L27/146A10R	. . . . .	[N: Reflectors] [N1108]
H01L27/146A12	. . . . .	[N: Pixel isolation structures] [N0605]
H01L27/146A14	. . . . .	[N: Wafer-level processed structures] [N0605]
H01L27/146A16	. . . . .	[N: Assemblies, i.e. Hybrid structures] [N0605]
H01L27/146A18	. . . . .	[N: Interconnect structures] [N0605]
H01L27/146A20	. . . . .	[N: Structures specially adapted for transferring the charges across the imager perpendicular to the imaging plane] [N1108]
H01L27/146A22	. . . . .	[N: Back illuminated imager structures] [N1108]
H01L27/146A24	. . . . .	[N: Electronic components shared by two or more pixel-elements, e.g. one amplifier shared by two pixel elements] [N1108]
H01L27/146F	. . . . .	[N: Photodiode arrays; MOS imagers]
H01L27/146F2	. . . . .	[N: Colour imagers]
H01L27/146F2M	. . . . .	[N: Multicolour imagers having a stacked pixel-element structure, e.g. npn, npnpn or MQW elements] [N9805]
H01L27/146F3	. . . . .	[N: Infra-red imagers]
H01L27/146F3H	. . . . .	[N: of the hybrid type]
H01L27/146F3M	. . . . .	[N: Multispectral infra-red imagers, having a stacked pixel-element structure, e.g. npn, npnpn or MQW structures] [N9805]
H01L27/146F4	. . . . .	[N: Blooming suppression]
H01L27/146F4O	. . . . .	[N: Overflow drain structures] [N0605]
H01L27/146F5	. . . . .	[N: X-ray, gamma-ray or corpuscular radiation imagers (measuring X-, gamma- or corpuscular radiation G01T1/00)] [N9805]
H01L27/146F5D	. . . . .	[N: Direct radiation imagers structures] [N0605]
H01L27/146F5H	. . . . .	[N: of the hybrid type] [N0605]
H01L27/146F5I	. . . . .	[N: Indirect radiation imagers e.g. using luminescent members] [N0605]
H01L27/146P	. . . . .	[N: Imagers using a photoconductor layer]
H01L27/146P2	. . . . .	[N: Colour imagers]
H01L27/146P3	. . . . .	[N: Infra-red imagers]
H01L27/146P3H	. . . . .	[N: of the hybrid type]
H01L27/146P4	. . . . .	[N: Blooming suppression]
H01L27/146P4O	. . . . .	[N: Overflow drain structures] [N0605]

- H01L27/146P5 [N: X-ray, gamma-ray or corpuscular radiation imagers (measuring X-, gamma- or corpuscular radiation [G01T1/00](#))] [N9805]
- H01L27/146R [N: Contact-type imagers] [N9805]
- H01L27/146S [N: Junction field effect transistor (JFET) imagers; static induction transistor (SIT) imagers]
- H01L27/146T [N: Bipolar transistor imagers]
- H01L27/146V [N: Processes or apparatus peculiar to the manufacture or treatment of these devices or parts thereof (not peculiar thereto H01L21/00)] [N0605]
- H01L27/146V2 [N: Process for coatings or optical elements] [N0605]
- H01L27/146V4 [N: Wafer level processing] [N0605]
- H01L27/146V6 [N: MOS based technologies] [N0605]
- H01L27/146V8 [N: Assemblies, i.e. hybrid integration] [N0605]
- H01L27/146V10 [N: Thin film technologies, e.g. amorphous, poly, micro or nanocrystalline silicon] [N0605]
- H01L27/146V12 [N: The active layers comprising only AlIIBV compounds, e.g. GaAs, InP] [N0605]
- H01L27/146V14 [N: The active layers comprising only AlIIBVI compounds, e.g. CdS, ZnS, CdTe] [N0605]
- H01L27/146V16 [N: Post-treatment for the devices, e.g. annealing, impurity-gettering, shor-circuit elimination, recrystallisation] [N0605]
- H01L27/148 Charge coupled imagers [N: (individual charge coupled devices [H01L29/765](#))] [C9805]
- H01L27/148A [N: Structural or functional details thereof] [N9805]
- H01L27/148A2 [N: Special geometry or disposition of pixel-elements, address lines or gate-electrodes] [N9805]
- H01L27/148A2S {7 dots} [N:Optical shielding] [N0605]
- H01L27/148B [N: Linear CCD imagers]
- H01L27/148C [N: Area CCD imagers]
- H01L27/148C2 [N: Frame-interline transfer] [N9805]
- H01L27/148C4 [N: Interline transfer] [N9805]
- H01L27/148C6 [N: Frame transfer] [N9805]
- H01L27/148C8 [N: Time-delay and integration] [N0605]
- H01L27/148D [N: CID imagers]
- H01L27/148F [N: CCD or CID colour imagers]
- H01L27/148J [N: Infra-red CCD or CID imagers]
- H01L27/148J2 [N: of the hybrid type]
- H01L27/148M [N: Blooming suppression]
- H01L27/148P [N: comprising a photoconductive layer deposited on the CCD structure]

- H01L27/15 including semiconductor components with at least one potential-jump barrier or surface barrier specially adapted for light emission [N: (monolithically integrated components including semiconductor laser components [H01S5/026](#))] [C0901]
- H01L27/15B [N: in a repetitive configuration, e.g. LED bars] [C0901]
- H01L27/15B2 [N: two-dimensional arrays] [N0204]

- H01L27/16 including thermoelectric components with or without a junction of dissimilar materials; including thermomagnetic components (using the Peltier effect only for cooling of

semiconductor or other solid state devices [H01L23/38](#))

- H01L27/18 . including components exhibiting superconductivity
- H01L27/20 . including piezo-electric components; including electrostrictive components; including magnetostrictive components [\[C0103\]](#)
- H01L27/22 . including components using galvano-magnetic effects, e.g. Hall effects; using similar magnetic field effects
- H01L27/22M . . [\[N: Magnetic non-volatile memory structures, e.g. MRAM\] \[N0909\] \[C1108\]](#)
- H01L27/22M2 . . . [\[N: comprising two-terminal components, e.g. diodes, MIM elements\] \[N0909\]](#)
- H01L27/22M4 . . . [\[N: comprising multi-terminal components, e.g. transistors\] \[N0909\]](#)
- H01L27/22M4F [\[N: of the field-effect transistor type\] \[N0909\]](#)
- H01L27/24 . including solid state components for rectifying, amplifying or switching without a potential-jump barrier or surface barrier, [\[N: e.g. resistance switching non-volatile memory structures\]](#)
- [\[N: **WARNING**](#)
[\[N1203\]Groups \[H01L27/24D\]\(#\) to \[H01L27/24H3C\]\(#\) are not complete pending reclassification; see provisionally also group \[H01L27/24\]\(#\)](#)
[\]](#)
- H01L27/24D . . [\[N: comprising two-terminal selection components, e.g. diodes\] \[N1203\]](#)
- H01L27/24D2 . . . [\[N: of the metal-insulator-metal type\] \[N1203\]](#)
- H01L27/24D4 . . . [\[N: of the Ovonic threshold switching type\] \[N1203\]](#)
- H01L27/24F . . [\[N: comprising multi-terminal selection components, e.g. transistors\] \[N1203\]](#)
- H01L27/24F2 . . . [\[N: of the bipolar type\] \[N1203\]](#)
- H01L27/24F4 . . . [\[N: of the vertical channel field-effect transistor type\] \[N1203\]](#)
- H01L27/24H . . [\[N: Arrangements comprising multiple bistable or multistable switching components of the same type on a plane parallel to the substrate, e.g. cross-point arrays, details of the horizontal layout\] \[N1203\]](#)
- H01L27/24H2 . . . [\[N: the switching components having a common active material layer\] \[N1203\]](#)
- H01L27/24H3 . . . [\[N: arranged in a direction perpendicular to the substrate, e.g. 3D cell arrays, details of the vertical layout\] \[N1203\]](#)
- H01L27/24H3C [\[N: the switching components being connected to a common vertical conductor\] \[N1203\]](#)
- H01L27/26 . including bulk negative resistance effect components
- H01L27/26B . . [\[N: Gunn effect devices\]](#)
- H01L27/28 . including components using organic materials as the active part, or using a combination of organic materials with other materials as the active part [\[N0308\]](#)
- H01L27/28B . . [\[N: Integrated circuits having a three-dimensional layout\] \[N0507\]](#)
- H01L27/28D . . [\[N: comprising components of the field-effect type\] \[N0507\]](#)
- H01L27/28F . . [\[N: Integrated circuits with a common active layer, e.g. cross point devices\] \[N0507\]](#)
- H01L27/28G . . [\[N: with an active region comprising an inorganic semiconductor\] \[N0507\]](#)
- H01L27/28K . . [\[N: Combination of organic light sensitive components with organic light emitting components, e.g. optocoupler\] \[N1108\]](#)

- H01L27/30 . . with components specially adapted for sensing infra-red radiation, light, electromagnetic radiation of shorter wavelength, or corpuscular radiation; with components specially adapted for either the conversion of the energy of such radiation into electrical energy or for the control of electrical energy by such radiation [N: (combination of organic light sensitive components with organic light emitting components, e.g. optocoupler [H01L27/28K](#))] [N0308] [C1207]
- H01L27/30B . . . [N: Energy conversion devices] [N0507]
- H01L27/30B2 [N: comprising multiple junctions, e.g. tandem cells] [N0507]
- H01L27/30B4 [N: in form of a fiber or a tube, e.g. photovoltaic fibers] [N1108]
- H01L27/30D . . . [N: Devices controlled by radiation] [N0507]
- H01L27/30D2 [N: Imager structures] [N0507]
- H01L27/30D4 [N: Devices specially adapted for detecting X-ray radiation (measuring X-radiation [G01T1/00](#))] [N1108]
- H01L27/32 . . with components specially adapted for light emission, e.g. flat-panel displays using organic light-emitting diodes (OLED) [N: combination of organic light sensitive components with organic light emitting components, e.g. optocoupler [H01L27/28K](#)] [N0308] [C1207]
- H01L27/32A . . . [N: OLEDs electrically connected in parallel] [N1108]
- H01L27/32B . . . [N: OLEDs electrically connected in series] [N1108]
- H01L27/32C . . . [N: Multi-colour light emission] [N0308]
- H01L27/32C2 [N: using stacked OLED] [N0308]
- H01L27/32C4 [N: using RGB sub-pixels] [N0308]
- [N: **WARNING**
[N1207]The subgroups of [H01L27/32C4](#) are not complete pending a reorganization, see provisionally also this group
]
- H01L27/32C4B [N: using more than three sub-pixels, e.g. RGBW] [N0507]
- H01L27/32C4C [N: the areas of RGB sub-pixels being different] [N1204]
- H01L27/32C4D [N: characterised by the geometrical arrangement of the RGB sub-pixels] [N1204]
- H01L27/32C6 [N: using colour filters or colour changing media (CCM)] [N0308]
- H01L27/32D [N: combined with dummy elements, i.e. non-functional features] [N1108]
- H01L27/32I [N: OLED integrated with another component ([H01L27/32D](#) takes precedence)] [N1108]
- H01L27/32I2 [N: the other component being a light sensitive element, e.g. inorganic solar cell, inorganic photodiode ([H01L27/28K](#) takes precedence)] [N1108]
- H01L27/32I4 [N: the other component being a touch screen] [N1108]
- H01L27/32I6 [N: the other component being a light modulating element, e.g. electrochromic element, photochromic element, liquid crystal element] [N1108]
- H01L27/32I8 [N: the other component being an imager structure ([H01L27/146](#) takes precedence)] [N1108]
- H01L27/32L [N: Displays not provided for in group [H01L27/32M](#) and subgroups, e.g. segment-type displays] [N1108]
- H01L27/32L2 [N: Light emitting logos] [N1108]
- H01L27/32M [N: Matrix-type displays] [N0308]

[N: **Notes**

[N1203] From 1.2.2012 onwards, groups [H01L27/32M8](#) and [H01L27/32M10](#) are no longer used for classification of new documents. The backfile is being reclassified to [H01L27/32M2](#) and [H01L27/32M4](#) and subgroups thereof]

H01L27/32M2	. . . . .	[N: Active matrix displays] [N0308]
H01L27/32M2B	. . . . .	[N: Banks, i.e. pixel defining layers] [N0903]
H01L27/32M2C	. . . . .	[N: Connection of the pixel electrode to the TFT] [N0903]
H01L27/32M2D	. . . . .	[N: Double substrate, i.e. with OLED and TFT on different substrates] [N0903]
H01L27/32M2D2	. . . . .	[N: Electrical connection of the two substrates] [N0903]
H01L27/32M2H	. . . . .	[N: Chiplets] [N1108]
H01L27/32M2I	. . . . .	[N: Insulating layers formed between TFT elements and OLED elements] [N1108]
H01L27/32M2L	. . . . .	[N: special geometry or disposition of pixel-elements] [N0903]
H01L27/32M2L2	. . . . .	[N: of TFT] [N0903]
H01L27/32M2L4	. . . . .	[N: of capacitor] [N0903]
H01L27/32M2M	. . . . .	[N: Dual display, i.e. having two independent displays] [N0903]
H01L27/32M2P	. . . . .	[N: Including photosensors to control luminance] [N0903]
H01L27/32M2S	. . . . .	[N: Shielding, e.g. of TFT] [N0903]
H01L27/32M2T	. . . . .	[N: including organic thin film transistors [OTFT]] [N1108]
H01L27/32M2W	. . . . .	[N: Wiring lines] [N0903]
H01L27/32M2W2	. . . . .	[N: comprising structures specially adapted for lowering the resistance] [N1108]
H01L27/32M4	. . . . .	[N: Passive matrix displays] [N0308]
H01L27/32M4B	. . . . .	[N: Including banks or shadow masks] [N0903]
H01L27/32M4M	. . . . .	[Dual display, i.e. having two independent displays] [N1203]
H01L27/32M4W	. . . . .	[N: Wiring lines] [N0903]
H01L27/32M4W2	. . . . .	[N: comprising structures specially adapted for lowering the resistance] [N1108]
H01L27/32M6	. . . . .	[N: Tiled displays] [N0308]
H01L27/32M8	. . . . .	[N: including banks or shadow masks] [N0308]
H01L27/32M10	. . . . .	[N: Wiring lines, e.g. power supply lines] [N0509]
H01L28/00		[N: Passive two-terminal components without a potential-jump or surface barrier for integrated circuits; Details thereof; Multistep manufacturing processes therefor (testing or measuring during manufacture H01L22/00 ; integration methods H01L21/70 ; integrated circuits H01L27/00 ; two-terminal components with a potential-jump or surface barrier H01L29/00 ; resistors in general H01C; inductors in general H01F; capacitors in general H01G)] [N1112] [C1205]
H01L28/10	. . . . .	[N: Inductors] [N1112]
H01L28/20	. . . . .	[N: Resistors] [N1112]
H01L28/22	. . . . .	[N: with an active material comprising carbon, e.g. diamond or diamond-like carbon [DLC]] [N1112]
H01L28/24	. . . . .	[N: with an active material comprising a refractory, transition or noble metal, metal

		or distribution of impurities within semiconductor regions]
H01L29/06B	. . .	[N: characterised by particular constructional design considerations, e.g. for preventing surface leakage, for controlling electric field concentration or for internal isolations regions (isolation regions between components H01L21/76 ; design considerations for integrated circuits H01L27/00 ; geometrical design considerations for devices H01L29/06C)] [C9601]
H01L29/06B2	. . . .	[N: for preventing surface leakage or controlling electric field concentration] [C9601]
H01L29/06B2B	. . . . .	[N: for increasing or controlling the breakdown voltage of reverse biased devices (H01L29/06C4 takes precedence)]
H01L29/06B2B3	. . . . .	[N: by the doping profile or the shape or the arrangement of the PN junction, or with supplementary regions, e.g. junction termination extension (JTE) (LDD or drain offset regions H01L29/78F)] [N9410] [C0610]
H01L29/06B2B3B	. . . . .	{7 dots} [N: with a supplementary region doped oppositely to or in rectifying contact with the semiconductor containing or contacting region, e.g. guard rings with PN or Schottky junction] [N9504] [C0704]
H01L29/06B2B3B2	. . . . .	{8 dots} [N: Buried supplementary region, e.g. buried guard ring (multi-RESURF H01L29/06B2B3R2)] [N0610]
H01L29/06B2B3C	. . . . .	{7 dots} [N: with a localised breakdown region, e.g. built-in avalanching region (in self-protected thyristors H01L29/74C)] [N9504] [C0610]
H01L29/06B2B3R	. . . . .	{7 dots} [N: Reduced surface field (RESURF) pn-junction structures] [N0610]
H01L29/06B2B3R2	. . . . .	{8 dots} [N: Multiple reduced surface field (multi-RESURF) structures, e.g. double RESURF, charge compensation, cool, superjunction (SJ), 3D-RESURF, composite buffer (CB) structures] [N0610]
H01L29/06B2C	. . . . .	[N: for preventing surface leakage due to surface inversion layer, e.g. with channel stopper (channel stoppers in combination with isolation region for integrated circuits H01L21/762)] [C0704]
H01L29/06B3	. . . . .	[N: Isolation within the component, i.e. internal isolation] [C0610]
H01L29/06B3B	. . . . .	[N: PN junctions]
H01L29/06B3C	. . . . .	[N: Dielectric regions, e.g. SiO ₂ regions, air gaps]
H01L29/06B3C2	. . . . .	[N: adjoining the input or output region of a field-effect device, e.g. the source or drain region] [C0610]
H01L29/06C	. . .	[N: characterised by the shape of the body]
H01L29/06C4	. . . . .	[N: specially adapted for altering the breakdown voltage by removing semiconductor material at, or in the neighbourhood of, a reverse biased junction, e.g. by bevelling, moat etching, depletion etching]
H01L29/06C6	. . . . .	[N: the shape of the body defining a nanostructure (nanotechnology per se B82B)] [N0601] [C1202]
H01L29/06C6W	. . . . .	[N: Nanowires or nanotubes (carbon nanotubes as material of solid-state device active part H01L51/00M4D)] [N1202]
H01L29/06C6W2	. . . . .	[N: oriented parallel to a substrate] [N1202]
H01L29/06C6W4	. . . . .	[N: oriented perpendicular or at an angle to a substrate] [N1202]
H01L29/06C6W6	. . . . .	[N: comprising a junction] [N1202]
H01L29/06D	. . .	[N: characterised by the shape, relative sizes or dispositions of the semiconductor regions or junctions between the regions]

H01L29/06D2	. . . .	[N: characterised by the particular shape of a junction between semiconductor regions]
H01L29/06D3	. . . .	[N: Surface layout]
H01L29/06D3B	. . . . .	[N: of cellular field-effect devices, e.g. multicellular DMOS transistors or IGBTs] [N9607]
H01L29/08	. . .	with semiconductor regions connected to an electrode carrying current to be rectified, amplified or switched and such electrode being part of a semiconductor device which comprises three or more electrodes
H01L29/08B	. . . .	[N: Emitter regions of bipolar transistors]
H01L29/08B2	. . . . .	[N: of lateral transistors]
H01L29/08B5	. . . . .	[N: Non-interconnected multi-emitter structures]
H01L29/08B7	. . . . .	[N: of heterojunction bipolar transistors (H01L29/737B4 takes precedence)] [N9604]
H01L29/08C	. . . .	[N: Collector regions of bipolar transistors]
H01L29/08C2	. . . . .	[N: Pedestal collectors]
H01L29/08D	. . . .	[N: Anode or cathode regions of thyristors or gated bipolar-mode devices]
H01L29/08D2	. . . . .	[N: Anode regions of thyristors or gated bipolar-mode devices, e.g. supplementary regions surrounding anode regions]
H01L29/08D3	. . . . .	[N: Cathode regions of thyristors]
H01L29/08E	. . . .	[N: Source or drain regions of field-effect devices]
H01L29/08E2	. . . . .	[N: of field-effect transistors with insulated gate (H01L29/06B3C2 takes precedence; with a passive supplementary region between source or drain and substrate related to punch-through, capacity or isolation phenomena H01L29/10F2B ; with LDD or DDD structure H01L29/78E ; for thin film transistors H01L29/786B4)] [C9703]
H01L29/08E2D	. . . . .	[N: of DMOS transistors] [N0610] [N: WARNING: This group and subgroups thereof are not complete, see provisionally also H01L29/08E2 and H01L29/78B and subgroups thereof] [C0704]
H01L29/08E2D2	. . . . . . . .	{7 dots} [N: Source regions] [N0610]
H01L29/08E2D2C	. . . . . . . .	{8 dots} [N: Impurity concentration or distribution] [N0610]
H01L29/08E2D2D	. . . . . . . .	{8 dots} [N: Disposition] [N0610]
H01L29/08E2D2S	. . . . . . . .	{8 dots} [N: Shape (cell layout H01L29/06D3B)] [N0610]
H01L29/08E2D4	. . . . . . . .	{7 dots} [N: Drain regions] [N0610]
H01L29/08E2D4C	. . . . . . . .	{8 dots} [N: Impurity concentration or distribution] [N0610]
H01L29/08E2D4D	. . . . . . . .	{8 dots} [N: Disposition] [N0610]
H01L29/08E2D4S	. . . . . . . .	{8 dots} [N: Shape] [N0610]
H01L29/08E3	. . . . .	[N: of field-effect transistors with Schottky gate]
H01L29/08T	. . . .	[N: Tunnel injectors]
H01L29/10	. . .	with semiconductor regions connected to an electrode not carrying current to be rectified, amplified or switched and such electrode being part of a semiconductor device which comprises three or more electrodes
H01L29/10B	. . . .	[N: Base region of bipolar transistors]
H01L29/10B2	. . . . .	[N: of lateral transistors]
H01L29/10C	. . . .	[N: Base regions of thyristors (H01L29/08D takes precedence)]
H01L29/10C2	. . . . .	[N: Anode base regions of thyristors]
H01L29/10C3	. . . . .	[N: Cathode base regions of thyristors]

H01L29/10D	. . . . .	[N: Channel region of field-effect devices]
H01L29/10D2	. . . . .	[N: of field-effect transistors]
H01L29/10D2B	. . . . .	[N: with insulated gate, e.g. characterised by the length, the width, the geometric contour or the doping structure (with channel and gate aligned in the lengthwise direction H01L29/423D2B7B ; with buried channel H01L29/78G)] [C9701]
H01L29/10D2B1	. . . . .	{7 dots} [N: and non-planar channel (resulting from the gate electrode disposition, e.g. within a trench, H01L29/423D2B5)] [N9410] [C1108]
H01L29/10D2B2	. . . . .	{7 dots} [N: with a non-uniform doping structure in the channel region surface] [C9601]
H01L29/10D2B2B	. . . . .	{8 dots} [N: the doping structure being parallel to the channel length, e.g. DMOS like] [N9410]
H01L29/10D2B3	. . . . .	{7 dots} [N: with vertical doping variation (H01L29/78C takes precedence)] [C9504]
H01L29/10D2B4	. . . . .	{7 dots} [N: with a variation of the composition, e.g. channel with strained layer for increasing the mobility] [C9802]
H01L29/10D2C	. . . . .	[N: with PN junction gate]
H01L29/10D3	. . . . .	[N: of charge coupled devices]
H01L29/10E	. . . . .	[N: Gate region of field-effect devices with PN junction gate]
H01L29/10F	. . . . .	[N: Substrate region of field-effect devices]
H01L29/10F2	. . . . .	[N: of field-effect transistors]
H01L29/10F2B	. . . . .	[N: with insulated gate] [N9410]
H01L29/10F2B2	. . . . .	{7 dots} [N: with an inactive supplementary region, e.g. for preventing punch-through, improving capacity effect or leakage current] [N9410]
H01L29/10F2B3	. . . . .	{7 dots} [N: characterised by the contact structure of the substrate region, e.g. for controlling or preventing bipolar effect] [N9410]
H01L29/10F3	. . . . .	[N: of charge coupled devices]
H01L29/10G	. . . . .	[N: Body region, i.e. base region, of DMOS transistors or IGBTs (cell layout H01L29/06D3B)] [C0610]
H01L29/12	. . . . .	characterised by the materials of which they are formed
H01L29/12W	. . . . .	[N: Single quantum well structures (single heterojunctions, couples of materials H01L29/165 , H01L29/205 , H01L29/225 , H01L29/267)] [N9504]
H01L29/12W2	. . . . .	[N: Quantum wire structures] [N9504]
H01L29/12W4	. . . . .	[N: Quantum box structures] [N9504]
H01L29/15	. . . . .	Structures with periodic or quasi periodic potential variation, e.g. multiple quantum wells, superlattices (such structures applied for the control of light G02F1/017 , applied in semiconductor lasers H01S5/34) [N9504] [C0103]

Note

Group [H01L29/15](#) takes precedence over groups [H01L29/16](#) to [H01L29/26](#).

H01L29/15B	. . . . .	[N: Compositional structures (H01L29/15C and H01L29/15D take precedence)] [N9504]
H01L29/15B2	. . . . .	[N: with quantum effects only in vertical direction, i.e. layered structures with quantum effects solely resulting from vertical potential variation] [N9504]
H01L29/15B2B	. . . . .	[N: comprising at least one long range structurally disordered material, e.g. one-dimensional vertical amorphous superlattices] [N9504]

- H01L29/15B2C [N: Comprising only semiconductor materials ([H01L29/15B2B](#) takes precedence)] [N9504]
- H01L29/15C [N: Doping structures, e.g. doping superlattices, nipi superlattices ([delta doping in general H01L29/36D](#))] [N9504]
- H01L29/15D [N: Structures without potential periodicity in a direction perpendicular to a major surface of the substrate, i.e. vertical direction, e.g. lateral superlattices, lateral surface superlattices (LSS)] [N9504]
- H01L29/16 . . . including, apart from doping materials or other impurities, only elements of the fourth group of the Periodic System in uncombined form [N: ([including SiC H01L29/24](#))] [C9504]
- H01L29/16D [N : Diamond] [N1107]
- H01L29/16E [N: Amorphous materials] [C9504]
- H01L29/16G [N: Graphene] [N1102]
- H01L29/16S [N: Silicon carbide] [N1108]
- H01L29/161 including two or more of the elements provided for in group [H01L29/16](#), [N: e.g. alloys ([H01L29/16E](#) takes precedence)] [C9504]
- H01L29/165 in different semiconductor regions, [N: e.g. heterojunctions] [C9504]
- H01L29/167 further characterised by the doping material [N: ([H01L29/16E](#) takes precedence)] [C9504]
- H01L29/18 . . . Selenium or tellurium only, apart from doping materials or other impurities [C9504]
- H01L29/18E [N: Amorphous materials] [C9504]
- H01L29/20 . . . including, apart from doping materials or other impurities, only AIIIBV compounds [C9504]
- H01L29/20B [N: Nitride compounds] [N0201]
- H01L29/20E [N: Amorphous materials] [C9504]
- H01L29/201 including two or more compounds, [N: e.g. alloys ([H01L29/20E](#) takes precedence)] [C9504]
- H01L29/205 in different semiconductor regions, [N: e.g. heterojunctions] [C9504]
- H01L29/207 further characterised by the doping material [N: ([H01L29/20E](#) takes precedence)] [C9504]
- H01L29/22 . . . including, apart from doping materials or other impurities, only AIIIBVI compounds [C9504]
- H01L29/22B [N: Cd X compounds being one element of the 6th group of the Periodic System ([H01L29/22E](#) takes precedence)] [C9504]
- H01L29/22E [N: Amorphous materials] [C9504]
- H01L29/221 including two or more compounds, [N: e.g. alloys ([H01L29/22E](#) takes precedence)] [C9504]
- H01L29/225 in different semiconductor regions, [N: e.g. heterojunctions] [C9504]
- H01L29/227 further characterised by the doping material [N: ([H01L29/22E](#) takes precedence)] [C9504]
- H01L29/24 . . . including, apart from doping materials or other impurities, only semiconductor materials not provided for in groups [H01L29/16](#), [H01L29/18](#), [H01L29/20](#), [H01L29/22](#) ([including organic materials H01L51/00](#)) [C9504]
- H01L29/24B [N: AIBVI or AIBVII compounds, e.g. Cu₂O, Cu I ([H01L29/24E](#) takes precedence)] [C9504]
- H01L29/24C [N: Pb compounds, e.g. PbO ([H01L29/24E](#) takes precedence)] [C9504]
- H01L29/24E [N: Amorphous materials] [C9504]

- H01L29/26 . . . including, apart from doping materials or other impurities, elements provided for in two or more of the groups [H01L29/16](#), [H01L29/18](#), [H01L29/20](#), [H01L29/22](#), [H01L29/24](#), [N: e.g. alloys] [C9504]
- H01L29/26E [N: Amorphous materials] [C9504]
- H01L29/267 in different semiconductor regions, [N: e.g. heterojunctions ([H01L29/26E takes precedence](#))] [C9504]
- H01L29/30 . . characterised by physical imperfections; having polished or roughened surface
- H01L29/32 . . . the imperfections being within the semiconductor body
- H01L29/34 . . . the imperfections being on the surface
- H01L29/36 . . characterised by the concentration or distribution of impurities [N: in the bulk material ([within semiconductor regions H01L29/06](#))]
- H01L29/36D . . . [N: Planar doping, e.g. atomic-plane doping, delta-doping]
- H01L29/40 . Electrodes; [N: Multistep manufacturing processes therefor] [C1203]
- H01L29/40M . . [N: Multistep manufacturing processes] [N1203]
- [N: **WARNING**
[N1203]This group is not complete, pending reorganisation, see provisionally group [H01L21/28E2B](#) and subgroups
]
- H01L29/40P . . [N: Field plates] [N0610]
- H01L29/40P2 . . . [N: Multiple field plate structures] [N0610]
- H01L29/40P4 . . . [N: Resistive arrangements, e.g. resistive or semi-insulating field plates] [N0610]
- H01L29/40P6 . . . [N: Recessed field plates, e.g. trench field plates, buried field plates] [N0610]
- H01L29/40S . . [N: with an insulating layer with a particular dielectric or electrostatic property, e.g. with static charges or for controlling trapped charges or moving ions, or with a plate acting on the insulator potential or the insulator charges, e.g. for controlling charges effect or potential distribution in the insulating layer, or with a semi-insulating layer contacting directly the semiconductor surface] [N0610]
- H01L29/41 . . characterised by their shape, relative sizes or dispositions [N9504]
- H01L29/41N . . . [N: Nanosized electrodes, e.g. nanowire electrodes comprising one or a plurality of nanowires (transparent electrodes comprising carbon nano-tubes [H01L51/44B2B](#), nanotechnology per se [B82B](#); nanosized carbon materials, e.g. carbon nanotubes, per se [C01B31/02B](#))] [N1204]
- H01L29/417 . . . carrying the current to be rectified, amplified or switched [N9504]
- H01L29/417B [N: Emitter or collector electrodes for bipolar transistors] [N9504]
- H01L29/417C [N: Cathode or anode electrodes for thyristors] [N9504]
- H01L29/417D [N: Source or drain electrodes for field effect devices ([with monocrystalline semiconductor on source/drain region H01L29/08E](#))] [N9504]
- H01L29/417D2 [N: for thin film transistors with insulated gate] [N9504]
- H01L29/417D4 [N: for vertical or pseudo-vertical devices] [N9908]
- [N: **Note**
A pseudo-vertical device is a device with the drain and source electrodes on the same main surface and where the main current is vertical at least in a part of its path
]
- H01L29/417D6 [N: for lateral devices where the connection to the source or drain region is done through at least one part of the semiconductor substrate]

thickness, e.g. with connecting sink or with via-hole] [N9908]

[N: **Note**

The sink or via-hole leading to the source or drain region is considered to form part of the source or drain electrode
]

H01L29/417D8 [N: for lateral devices with structured layout for source or drain region, i.e. the source or drain region having cellular, interdigitated or ring structure or being curved or angular ([H01L29/417D2](#) to [H01L29/417D6](#) take precedence)] [N9908]

[N: **Note**

Interdigitated structure means that at least one of the source or drain region has two or more fingers
]

H01L29/417D10 [N: with at least part of the source or drain electrode having contact below the semiconductor surface, e.g. the source or drain electrode formed at least partially in a groove or with inclusions of conductor inside the semiconductor ([H01L29/417D2](#) to [H01L29/417D8](#) take precedence)] [N9908]

H01L29/417D12 [N: characterised by the proximity or the relative position of the source or drain electrode and the gate electrode, e.g. the source or drain electrode separated from the gate electrode by side-walls or spreading around or above the gate electrode] [N9908] [C1203]

H01L29/417D12R [N: Raised source or drain electrodes self aligned with the gate] [N1204]

H01L29/417D14 [N: for transistors with a horizontal current flow in a vertical sidewall, e.g. FinFET, MuGFET] [N1009]

H01L29/423 not carrying the current to be rectified, amplified or switched [N9504]

H01L29/423B [N: Base electrodes for bipolar transistors] [N9504]

H01L29/423C [N: Gate electrodes for thyristors] [N9504]

H01L29/423D [N: Gate electrodes for field effect devices] [N9504]

H01L29/423D2 [N: for field-effect transistors] [N9504]

H01L29/423D2B [N: with insulated gate] [N9504]

H01L29/423D2B2 {7 dots} [N: Gate electrodes for transistors with a floating gate] [N9701]

H01L29/423D2B2B {8 dots} [N: with at least one additional gate other than the floating gate and the control gate, e.g. program gate, erase gate or select gate] [N0312]

H01L29/423D2B2C {8 dots} [N: with the floating gate formed by two or more non connected parts, e.g. multi-particles floating gate] [N0312]

H01L29/423D2B2D {8 dots} [N: with one gate at least partly formed in a trench] [N0312]

H01L29/423D2B3 {7 dots} [N: Gate electrodes for transistors with charge trapping gate insulator] [N0704]

H01L29/423D2B3B {8 dots} [N: with at least one additional gate, e.g. program gate, erase gate or select gate] [N0704]

H01L29/423D2B3C {8 dots} [N: with trapping site formed by at least two separated sites, e.g. multi-particles trapping site] [N0704]

H01L29/423D2B3D {8 dots} [N: with the gate at least partly formed in a trench] [N0704]

H01L29/423D2B5	. . . . .	{7 dots} [N: Disposition, e.g. buried gate electrode (H01L29/423D2B2 and H01L29/423D2B3 take precedence)] [N0610] [C0704] [N: WARNING: This group and subgroup thereof are not complete, see provisionally also H01L29/78, H01L29/78B and subgroups thereof, H01L29/78C and H01L29/78F2] [C0704]
H01L29/423D2B5T	. . . . .	{8 dots} [N: within a trench, e.g. trench gate electrode, groove gate electrode] [N0610] [C0704]
H01L29/423D2B6	. . . . .	{7 dots} [N: characterised by the insulating layer, e.g. thickness or uniformity (H01L29/423D2B2 and H01L29/423D2B3 take precedence) [N9504] [C9704]
H01L29/423D2B6B	. . . . .	{8 dots} [N: the thickness being non-uniform] [N9504] [C9506]
H01L29/423D2B7	. . . . .	{7 dots} [N: characterised by the conducting layer, e.g. the length, the sectional shape or the lay-out (H01L29/423D2B2 takes precedence)] [N9504] [C9701]
H01L29/423D2B7B	. . . . .	{8 dots} [N: characterised by the length or the sectional shape] [N9504] [C9506]
H01L29/423D2B7C	. . . . .	{8 dots} [N: characterised by the surface lay-out] [N9504]
H01L29/423D2B8	. . . . .	{7 dots} [N: for thin film field effect transistors, e.g. characterised by the thickness or the shape of the insulator or the dimensions, the shape or the lay-out of the conductor][C9706]
H01L29/423D2B8G	. . . . .	{8 dots} [N: fully surrounding the channel, e.g. gate-all-around] [N1204]
H01L29/423D3	. . . . .	[N: for charge coupled devices] [N9504]
H01L29/43	. . . . .	characterised by the materials of which they are formed [N9504]
H01L29/43B	. . . . .	[N: Heterojunction gate for field effect devices] [N9504]
H01L29/43C	. . . . .	[N: Resistive materials for field effect devices, e.g. resistive gate for MOSFET or MESFET] [N9504] [C9609]
H01L29/43D	. . . . .	[N: Superconductor materials] [N9504]
H01L29/45	. . . . .	Ohmic electrodes [N9504]
H01L29/45B	. . . . .	[N: on AIII-BV compounds] [N9504]
H01L29/45B2	. . . . .	[N: on thin film AIII-BV compounds] [N9504]
H01L29/45S	. . . . .	[N: on silicon] [N9504]
H01L29/45S2	. . . . .	[N: for thin film silicon, e.g. source or drain electrode] [N9504]
H01L29/47	. . . . .	Schottky barrier electrodes [N: (H01L29/43C takes precedence)] [N9504] [C9609]
H01L29/47B	. . . . .	[N: on AIII-BV compounds] [N9504]
H01L29/49	. . . . .	Metal-insulator-semiconductor electrodes, [N: e.g. gates of MOSFET (H01L29/43C takes precedence)] [N9504] [C9811]
		[N: Note This group covers also devices using any other conductor material in place of metal]
H01L29/49B	. . . . .	[N: for thin film semiconductor, e.g. gate of TFT] [N9504]
H01L29/49C	. . . . .	[N: the conductor material next to the insulator being a silicon layer, e.g. polysilicon doped with boron, phosphorus or nitrogen (H01L29/49B, H01L29/49F take precedence)] [N9811]
H01L29/49C2	. . . . .	[N: with a multiple layer structure, e.g. several silicon layers with different crystal structure or grain arrangement (with only a vertical doping structure or vertical doping variation H01L29/49C)] [N9811]

- H01L29/49C2B [N: with a silicide layer contacting the silicon layer, e.g. Polycide gate (with a barrier layer between the silicide and silicon layers [H01L29/49C2C](#))] [N9811]
- H01L29/49C2C [N: with a barrier layer between the silicon and the metal or metal silicide upper layer, e.g. Silicide/TiN/Polysilicon]
- H01L29/49D [N: the conductor material next to the insulator being a simple metal, e.g. W, Mo ([H01L29/49B](#), [H01L29/49F](#) take precedence)] [N9811]
- H01L29/49D2 [N: with a multiple layer structure] [N9811]
- H01L29/49E [N: the conductor material next to the insulator being a composite material, e.g. organic material, TiN, MoSi₂ ([H01L29/49B](#), [H01L29/49F](#) take precedence)] [N9811]
- H01L29/49E2 [N: being a silicide layer, e.g. TiSi₂] [N9811]
- H01L29/49F [N: with a lateral structure, e.g. a Polysilicon gate with a lateral doping variation or with a lateral composition variation or characterised by the sidewalls being composed of conductive, resistive or dielectric material] [N9811]
- H01L29/49F2 [N: comprising an air gap][N: Warning: Not complete, see provisionally also H01L29/49F] [N1204]
- H01L29/51 Insulating materials associated therewith [N: (for MIS structures on thin film semiconductor [H01L29/49B](#))] [N9504]
- H01L29/51B [N: with a compositional variation, e.g. multilayer structures (H01L29/51F takes precedence)] [N9504] [C0605]
- H01L29/51B1 [N: the variation being parallel to the channel plane] [N0601]
- H01L29/51B2 [N: the variation being perpendicular to the channel plane] [N0601]
- H01L29/51C [N: with cavities, e.g. containing a gas] [N0601]
- H01L29/51F [N: with at least one ferroelectric layer] [N9701]
- H01L29/51M [N: the insulating material comprising a metallic compound, e.g. metal oxide, metal silicate (H01L29/51N takes precedence)] [N0601]
- H01L29/51N [N: the insulating material containing nitrogen, e.g. nitride, oxynitride, nitrogen-doped material] [N0601]
- H01L29/66 Types of semiconductor device; [N: Multistep manufacturing processes therefor] [C1203]
- H01L29/66M [N: Multistep manufacturing processes] [N1203]
- H01L29/66M2 [N: of devices having a semiconductor body comprising semiconducting carbon, e.g. diamond, diamond-like carbon, graphene] [N1203]
- H01L29/66M2D [N: the devices being controllable only by variation of the electric current supplied or the electric potential applied, to one or more of the electrodes carrying the current to be rectified, amplified, oscillated or switched, e.g. two-terminal devices] [N1203]
- H01L29/66M2D2 [N: Diodes] [N1203]
- H01L29/66M2T [N: the devices being controllable only by the electric current supplied or the electric potential applied, to an electrode which does not carry the current to be rectified, amplified or switched, e.g. three-terminal devices] [N1203]
- H01L29/66M2T2 [N: Field-effect transistors] [N1203]
- H01L29/66M4 [N: of devices having a semiconductor body comprising crystalline silicon carbide] [N1203]
- H01L29/66M4D [N: the devices being controllable only by variation of the electric current supplied or the electric potential applied, to one or more of the electrodes carrying the current to be rectified, amplified, oscillated or switched, e.g.

		two-terminal devices] [N1203]
H01L29/66M4T	. . . .	[N: the devices being controllable only by the electric current supplied or the electric potential applied, to an electrode which does not carry the current to be rectified, amplified or switched, e.g. three-terminal devices] [N1203]
H01L29/66M6	. . . .	[N: of devices having semiconductor bodies comprising group 14 or group 13/15 materials (comprising semiconducting carbon H01L29/66M2 ; comprising crystalline silicon carbide H01L29/66M4)] [N1203]
H01L29/66M6D	. . . .	[N: the devices being controllable only by variation of the electric current supplied or the electric potential applied, to one or more of the electrodes carrying the current to be rectified, amplified, oscillated or switched, e.g. two-terminal devices] [N1203]
H01L29/66M6D2	. . . . .	[N: Diodes] [N1203]
H01L29/66M6D2B	. . . . .	[N: Breakdown diodes] [N1203]
H01L29/66M6D2B2	. . . . .	{7 dots} [N: Zener diodes] [N1203]
H01L29/66M6D2B4	. . . . .	{7 dots} [N: Avalanche diodes] [N1203]
H01L29/66M6D2M	. . . . .	[N: Multilayer diodes, e.g. PNPN diodes] [N1203]
H01L29/66M6D2P	. . . . .	[N: Planar diodes] [N1203]
H01L29/66M6D2R	. . . . .	[N: PN junction diodes] [N1203]
H01L29/66M6D2S	. . . . .	[N: Schottky diodes] [N1203]
H01L29/66M6D2T	. . . . .	[N: Tunnel diodes (group 13/15 resonant tunneling diodes H01L29/66M6D8D4)] [N1203]
H01L29/66M6D2V	. . . . .	[N: Transit time diodes, e.g. IMPATT, TRAPATT diodes] [N1203]
H01L29/66M6D4	. . . . .	[N: Resistors with PN junction] [N1203]
H01L29/66M6D5	. . . . .	[N: Capacitors with PN or Schottky junction, e.g. varactors (capacitors with PN junction combined with MOS control H01L29/66M6D6H)] [N1203]
H01L29/66M6D6	. . . . .	[N: Conductor-insulator-semiconductor capacitors, e.g. trench capacitors] [N1203]
H01L29/66M6D6H	. . . . .	[N: with PN junction, e.g. hybrid capacitors] [N1203]
H01L29/66M6D8	. . . . .	[N: with an active layer made of a group 13/15 material] [N1203]
H01L29/66M6D8D	. . . . .	[N: Diodes] [N1203]
H01L29/66M6D8D2	. . . . .	{7 dots} [N: Schottky diodes] [N1203]
H01L29/66M6D8D4	. . . . .	{7 dots} [N: with a heterojunction, e.g. resonant tunneling diodes [RTD]] [N1203]
H01L29/66M6T	. . . . .	[N: the devices being controllable only by the electric current supplied or the electric potential applied, to an electrode which does not carry the current to be rectified, amplified or switched, e.g. three-terminal devices] [N1203]
H01L29/66M6T2	. . . . .	[N: Bipolar junction transistors [BJT]] [N1203]
H01L29/66M6T2H	. . . . .	[N: Heterojunction transistors [HBT] (with an active layer made of a group 13/15 material H01L29/66M6T2V2)] [N1203]
H01L29/66M6T2L	. . . . .	[N: Lateral transistors (H01L29/66M6T2H and H01L29/66M6T2T take precedence)] [N1203]
H01L29/66M6T2S	. . . . .	[N: Schottky transistors] [N1203]
H01L29/66M6T2T	. . . . .	[N: Thin film bipolar transistors (H01L29/66M6T2H takes precedence)] [N1203]
H01L29/66M6T2U	. . . . .	[N: Silicon vertical transistors (H01L29/66M6T2H , H01L29/66M6T2S and H01L29/66M6T2T take precedence)] [N1203]
H01L29/66M6T2U2	. . . . .	{7 dots} [N: Inverse transistors] [N1203]

H01L29/66M6T2U4	{7 dots} [N: with a single crystalline emitter, collector or base including extrinsic, link or graft base formed on the silicon substrate, e.g. by epitaxy, recrystallisation, after insulating device isolation (H01L29/66M6T2U2 takes precedence)] [N1203]
H01L29/66M6T2U6	{7 dots} [N: with main current going through the whole silicon substrate, e.g. power bipolar transistor] [N1203]
H01L29/66M6T2U6E	{8 dots} [N: with multi-emitter, e.g. interdigitated, multi-cellular or distributed emitter] [N1203]
H01L29/66M6T2V	[N: with an active layer made of a group 13/15 material] [N1203]
H01L29/66M6T2V2	{7 dots} [N: Heterojunction transistors] [N1203]
H01L29/66M6T2W	[N: controlled by field-effect, e.g. insulated gate bipolar transistors [IGBT]] [N1203]
H01L29/66M6T2W4	{7 dots} [N: Vertical insulated gate bipolar transistors] [N1203]
H01L29/66M6T2W4R	{8 dots} [N: with a recess formed by etching in the source/emitter contact region (H01L29/66M6T2W4T takes precedence; etching of semiconductor bodies H01L21/302)] [N1203]
H01L29/66M6T2W4T	{8 dots} [N: with a recessed gate] [N1203]
H01L29/66M6T3	[N: Gated diodes, e.g. field controlled diodes [FCD], static induction thyristors [SITh], field controlled thyristors [FCTh]] [N1203]
H01L29/66M6T4	[N: Thyristors] [N1203]
H01L29/66M6T4A	[N: structurally associated with another device, e.g. built-in diode (making integrated circuits H01L21/82)] [N1203]
H01L29/66M6T4A2	{7 dots} [N: the other device being a controlling field-effect device] [N1203]
H01L29/66M6T4B	[N: Bidirectional thyristors] [N1203]
H01L29/66M6T4L	[N: Lateral or planar thyristors] [N1203]
H01L29/66M6T4V	[N: with an active layer made of a group 13/15 material] [N1203]
H01L29/66M6T6	[N: Unipolar field-effect transistors] [N1203]
H01L29/66M6T6B	[N: Static induction transistors [SIT] (with an active layer made of a group 13/15 material H01L29/66M6T6E2)] [N1203]
H01L29/66M6T6B2	{7 dots} [N: Permeable base transistors [PBT]] [N1203]
H01L29/66M6T6C	[N: with a heterojunction interface channel or gate, e.g. HFET, HIGFET, SISFET, HJFET, HEMT (with an active layer made of a group 13/15 material H01L29/66M6T6E3)] [N1203]
H01L29/66M6T6D	[N: with a one- or zero-dimensional channel, e.g. quantum wire FET, in-plane gate transistor [IPG], single electron transistor [SET], striped channel transistor, Coulomb blockade transistor (with an active layer made of a group 13/15 material H01L29/66M6T6E4)] [N1203]
H01L29/66M6T6E	[N: with an active layer made of a group 13/15 material, e.g. group 13/15 velocity modulation transistor [VMT], group 13/15 negative resistance FET [NERFET]] [N1203]
H01L29/66M6T6E2	{7 dots} [N: Static induction transistors [SIT], e.g. permeable base transistors [PBT]] [N1203]
H01L29/66M6T6E3	{7 dots} [N: with a heterojunction interface channel or gate, e.g. HFET, HIGFET, SISFET, HJFET, HEMT] [N1203]
H01L29/66M6T6E4	{7 dots} [N: with one- or zero-dimensional channel, e.g. quantum wire field-effect transistors, in-plane gate transistors [IPG], single electron transistors [SET], Coulomb blockade transistors, striped channel transistors] [N1203]

H01L29/66M6T6F	. . . . .	[N: with an insulated gate, i.e. MISFET] [N1203]
H01L29/66M6T6F1	. . . . .	{7 dots} [N: with multiple gate, at least one gate being an insulated gate (H01L29/66M6T6F15 takes precedence)] [N1203]
H01L29/66M6T6F2	. . . . .	{7 dots} [N: with a pocket or a lightly doped drain selectively formed at the side of the gate] [N1203]
H01L29/66M6T6F3	. . . . .	{7 dots} [N: using self aligned silicidation, i.e. silicide (formation of conductive layers comprising silicides H01L21/285B4A)] [N1203]
H01L29/66M6T6F3B	. . . . .	{8 dots} [N: providing different silicide thicknesses on the gate and on source or drain] [N1203]
H01L29/66M6T6F4	. . . . .	{7 dots} [N: using self aligned selective metal deposition simultaneously on the gate and on source or drain] [N1203]
H01L29/66M6T6F5	. . . . .	{7 dots} [N: with an active layer made of a group 13/15 material (H01L29/66M6T6E takes precedence)] [N1203]
H01L29/66M6T6F6	. . . . .	{7 dots} [N: using the removal of at least part of spacer, e.g. disposable spacer] [N1203]
H01L29/66M6T6F7	. . . . .	{7 dots} [N: using a self aligned punch through stopper or threshold implant under the gate region (H01L29/66M6T6F11C takes precedence)] [N1203]
H01L29/66M6T6F8	. . . . .	{7 dots} [N: using a dummy, i.e. replacement gate in a process wherein at least a part of the final gate is self aligned to the dummy gate] [N1203]
H01L29/66M6T6F9	. . . . .	{7 dots} [N: using inside spacers, permanent or not] [N1203]
H01L29/66M6T6F10	. . . . .	{7 dots} [N: using multiple spacer layers, e.g. multiple sidewall spacers] [N1203]
H01L29/66M6T6F11	. . . . .	{7 dots} [N: Lateral single gate silicon transistors] [N1203]
H01L29/66M6T6F11B	. . . . .	{8 dots} [N: where the source and drain or source and drain extensions are self-aligned to the sides of the gate (H01L29/66M6T6F11C takes precedence)] [N1203]
H01L29/66M6T6F11B2	. . . . .	{9 dots} [N: with initial gate mask or masking layer complementary to the prospective gate location, e.g. with dummy source and drain contacts] [N1203]
H01L29/66M6T6F11B3	. . . . .	{9 dots} [N: with both lightly doped source and drain extensions and source and drain self-aligned to the sides of the gate, e.g. lightly doped drain [LDD] MOSFET, double diffused drain [DDD] MOSFET] [N1203]
H01L29/66M6T6F11B3B	. . . . .	{10 dots} [N: forming drain [D] and lightly doped drain [LDD] simultaneously, e.g. using implantation through the wings a T-shaped layer, or through a specially shaped layer] [N1203]
H01L29/66M6T6F11C	. . . . .	{8 dots} [N: with final source and drain contacts formation strictly before final or dummy gate formation, e.g. contact first technology (H01L29/66M6T6F11D2 takes precedence)] [N1203]
H01L29/66M6T6F11D	. . . . .	{8 dots} [N: with a gate recessing step, e.g. using local oxidation (making recessed gate LDMOS transistors H01L29/66M6T6F14L4)] [N1203]
H01L29/66M6T6F11D2	. . . . .	{9 dots} [N: using etching to form a recess at the gate location (etching of semiconductor bodies H01L21/302)] [N1203]
H01L29/66M6T6F11D3	. . . . .	{9 dots} [N: recessing the gate by forming single crystalline semiconductor material at the source or drain location] [N1203]

H01L29/66M6T6F11E.	{8 dots} [N: with source or drain recessed by etching or first recessed by etching and then refilled] [N1203]
H01L29/66M6T6F11F.	{8 dots} [N: with source or drain regions formed by a Schottky barrier or a conductor-insulator-semiconductor structure] [N1203]
H01L29/66M6T6F11G.	{8 dots} [N: with a single crystalline channel formed on the silicon substrate after insulating device isolation] [N1203]
H01L29/66M6T6F11H.	{8 dots} [N: with asymmetry in the channel direction, e.g. lateral high-voltage MISFETs with drain offset region, extended drain MISFETs] [N1203]
H01L29/66M6T6F12	{7 dots} [N: Vertical transistors (H01L29/66M6T6F14V , H01L29/66M6T6F15 take precedence)] [N1203]
H01L29/66M6T6F14	{7 dots} [N: DMOS transistors, i.e. MISFETs with a channel accommodating body or base region adjoining a drain drift region (making lateral high-voltage MISFETs with channel well and drain offset region H01L29/66M6T6F11H)] [N1203]
H01L29/66M6T6F14L.	{8 dots} [N: Lateral DMOS transistors, i.e. LDMOS transistors] [N1203]
	[N: WARNING [N1203] This group and subgroups thereof are not complete, see provisionally also H01L29/66M6T6F14]
H01L29/66M6T6F14L2	{9 dots} [N: with a step of forming an insulating sidewall spacer (forming insulating material on a substrate H01L21/02K2)] [N1203]
H01L29/66M6T6F14L3	{9 dots} [N: with a step of recessing the source electrode] [N1203]
H01L29/66M6T6F14L4	{9 dots} [N: with a step of recessing the gate electrode, e.g. to form a trench gate electrode] [N1203]
H01L29/66M6T6F14V.	{8 dots} [N: Vertical DMOS transistors, i.e. VDMOS transistors] [N1203]
H01L29/66M6T6F14V2	{9 dots} [N: With a step of forming an insulating sidewall spacer] [N1203]
	[N: WARNING [N1203] This group is not complete, see provisionally also H01L29/66M6T6F14V]
H01L29/66M6T6F14V3	{9 dots} [N: with a step of recessing the source electrode] [N1203]
H01L29/66M6T6F14V4	{9 dots} [N: with a step of recessing the gate electrode, e.g. to form a trench gate electrode] [N1203]
H01L29/66M6T6F15	{7 dots} [N: Thin film unipolar transistors] [N1203]
H01L29/66M6T6F15A.	{8 dots} [N: Amorphous silicon or polysilicon transistors] [N1203]
H01L29/66M6T6F15A2	{9 dots} [N: Lateral single gate single channel transistors with non-inverted structure, i.e. the channel layer is formed before the gate] [N1203]
H01L29/66M6T6F15A3	{9 dots} [N: Lateral single gate single channel transistors with inverted structure, i.e. the channel layer is formed after the gate] [N1203]

H01L29/66M6T6F15C.	{8 dots} [N: Monocrystalline silicon transistors on insulating substrates, e.g. quartz substrates (H01L29/66M6T6F12 takes precedence; thin film FinFETs H01L29/66M6T6F16B)] [N1203]
H01L29/66M6T6F15C2	{9 dots} [N: on sapphire substrates, e.g. SOS transistors] [N1203]
H01L29/66M6T6F16	{7 dots} [N: with a gate at the side of the channel] [N1203]
H01L29/66M6T6F16F.	{8 dots} [N: with a horizontal current flow in a vertical sidewall of a semiconductor body, e.g. FinFET, MuGFET] [N1203]
H01L29/66M6T6F16F2	{9 dots} [N: with a step of doping the vertical sidewall, e.g. using tilted or multi-angled implants] [N1203]
H01L29/66M6T6F16F3	{9 dots} [N: using dummy structures having essentially the same shape as the semiconductor body, e.g. to provide stability] [N1203]
H01L29/66M6T6F16F4	{9 dots} [N: the channel being thinned after patterning, e.g. sacrificial oxidation on fin] [N1203]
H01L29/66M6T6F17	{7 dots} [N: with a floating gate (H01L29/66M6T6F19 takes precedence)] [N1203]
H01L29/66M6T6F18	{7 dots} [N: with a charge trapping gate insulator, e.g. MNOS transistors] [N1203]
H01L29/66M6T6F19	{7 dots} [N: with a ferroelectric gate insulator] [N1203]
H01L29/66M6T6S	[N: with a Schottky gate, i.e. MESFET] [N1203]
H01L29/66M6T6S2	{7 dots} [N: with an active layer made of a group 13/15 material (H01L29/66M6T6E takes precedence)] [N1203]
H01L29/66M6T6S2L	{8 dots} [N: Lateral single gate transistors] [N1203]
H01L29/66M6T6S2L2.	{9 dots} [N: Processes wherein the final gate is made after the formation of the source and drain regions in the active layer, e.g. dummy-gate processes] [N1203]
H01L29/66M6T6S2L3.	{9 dots} [N: Processes wherein the final gate is made before the formation, e.g. activation anneal, of the source and drain regions in the active layer] [N1203]
H01L29/66M6T6S2L4.	{9 dots} [N: Lateral transistors with two or more independent gates] [N1203]
H01L29/66M6T6T	[N: with a PN junction gate, i.e. JFET] [N1203]
H01L29/66M6T6T2	{7 dots} [N: with a PN homojunction gate] [N1203]
H01L29/66M6T6T2V	{8 dots} [N: Vertical transistors, e.g. tectnetrons] [N1203]
H01L29/66M6T6T3	{7 dots} [N: with a PN heterojunction gate] [N1203]
H01L29/66M6T6T8	{7 dots} [N: with an active layer made of a group 13/15 material (H01L29/66M6T6E takes precedence)] [N1203]
H01L29/66M6T7	[N: BJT-like unipolar transistors, e.g. hot electron transistors [HET], metal base transistors [MBT], resonant tunneling transistor [RTT], bulk barrier transistor [BBT], planar doped barrier transistor [PDBT], charge injection transistor [CHINT]] [N1203]
H01L29/66M6T7B	[N: with an active layer made of a group 13/15 material] [N1203]
H01L29/66M6T9	[N: Charge transfer devices] [N1203]
H01L29/66M6T9B	[N: with an insulated gate] [N1203]
H01L29/66M6T9C	[N: with a Schottky gate] [N1203]
H01L29/66M8	[N: of devices having semiconductor bodies not comprising group 14 or group 13/15 materials (comprising selenium or tellurium in uncombined form other than as impurities in semiconductor bodies of other materials, comprising

- cuprous oxide or cuprous iodide [H01L21/02K4](#)) [N1203]
- H01L29/66Q . . [N: Quantum effect devices, e.g. using quantum reflection, diffraction or interference effects, i.e. Bragg- or Aharonov-Bohm effects] [C9709]
- H01L29/66S . . [N: Devices using spin polarized carriers][N0302]
- H01L29/66T . . [N: controllable only by the variation of applied heat (controllable by IR radiation [H01L31/00](#); measuring quantity of heat [G01K17/00](#))] [N1203]
- H01L29/68 . . controllable by only the electric current supplied, or only the electric potential applied, to an electrode which does not carry the current to be rectified, amplified or switched
- H01L29/68E . . . [N: Hi-Lo semiconductor devices, e.g. memory devices]
- H01L29/70 . . . Bipolar devices
- H01L29/70B [N: Double base diodes]
- H01L29/72 Transistor-type devices, i.e. able to continuously respond to applied control signals [C9504]
- H01L29/73 Bipolar junction transistors [C9504]
- H01L29/73B [N: structurally associated with other devices (assemblies of devices [H01L25/00](#); integrated circuits [H01L27/00](#); IGBT [H01L29/739C](#))] [C9504]
- H01L29/73B2 {7 dots} [N: the device being a resistive element, e.g. ballasting resistor (transistors integrated with resistors [H01L27/07T2](#))]
- H01L29/73C [N: Point contact transistors]
- H01L29/73D [N: Schottky transistors]
- H01L29/73E [N: Tunnel transistors]
- H01L29/73F [N: Avalanche transistors]
- H01L29/73J [N: Transistors with hook collector]
- H01L29/73K [N: Bipolar thin film transistors]
- H01L29/732 Vertical transistors [N9504]
- H01L29/732B {7 dots} [N: having emitter-base and base-collector junctions leaving at the same surface of the body, e.g. planar transistor] [N9504]
- H01L29/732C {7 dots} [N: having an emitter-base junction leaving at a main surface and a base-collector junction leaving at a peripheral surface of the body, e.g. mesa planar transistor] [N9504]
- H01L29/732D {7 dots} [N: Inverse vertical transistors] [N9504]
- H01L29/735 Lateral transistors [N9504]
- H01L29/737 Hetero-junction transistors [N9504]
- H01L29/737B {7 dots} [N: Vertical transistors] [N9504]
- H01L29/737B2 {8 dots} [N: having a two-dimensional base, e.g. modulation-doped base, inversion layer base, delta-doped base] [N9504]
- H01L29/737B4 {8 dots} [N: having an emitter comprising one or more non-monocrystalline elements of group IV, e.g. amorphous silicon, alloys comprising group IV elements] [N9504]
- H01L29/737B6 {8 dots} [N: Resonant tunnelling transistors] [N9504]
- H01L29/737B8 {8 dots} [N: comprising lattice mismatched active layers, e.g. SiGe strained layer transistors] [N9504]
- H01L29/739 controlled by field-effect, [N: e.g. bipolar static induction transistors (BSIT) (unijunction transistors [H01L29/70B](#))] [N9504]

H01L29/739B	. . . . .	[N: Gated diode structures] [N9504]
H01L29/739B2	. . . . .	{7 dots} [N: with PN junction gate, e.g. field controlled thyristors (FCTh), static induction thyristors (SITh)] [N9504]
H01L29/739C	. . . . .	[N: Insulated gate bipolar mode transistors, i.e. IGBT; IGT; COMFET] [N9504]
H01L29/739C1	. . . . .	{7 dots} [N: on an insulating layer or substrate, e.g. thin film device or device isolated from the bulk substrate (H01L29/739C2C takes precedence)] [N9711] [C9803]
H01L29/739C2	. . . . .	{7 dots} [N: Vertical transistors, e.g. vertical IGBT] [N9504]
		[N: Note The transistor is called vertical if the emitter and the collector are not on the same main surface or, if they are on the same main surface, at least a part of the main current has a component substantially not parallel to the main surface]
H01L29/739C2B	. . . . .	{8 dots} [N: with a non planar surface, e.g. with a non planar gate or with a trench or recess or pillar in the surface of the emitter, base or collector region for improving current density or short circuiting the emitter and base regions (H01L29/739C2C takes precedence)] [N9504] [C9607]
H01L29/739C2B2	. . . . .	{9 dots} [N: and a gate structure lying on a slanted or vertical surface or formed in a groove, e.g. trench gate IGBT] [N9506]
H01L29/739C2C	. . . . .	{8 dots} [N: with both emitter and collector contacts in the same substrate side] [N9504]
H01L29/74	. . . . .	Thyristor-type devices, e.g. having four-zone regenerative action[N: (two-terminal thyristors H01L29/87)] [C9504]
H01L29/74B	. . . . .	[N: structurally associated with at least one other device (assemblies H01L25/00 ; integrated circuits H01L27/00)] [N9504]
H01L29/74B2	. . . . .	[N: the device being a capacitor or a resistor] [N9504]
H01L29/74B4	. . . . .	[N: the device being a diode] [N9504]
H01L29/74B4B	. . . . .	{7 dots} [N: the device being an antiparallel diode, e.g. RCT (shorted anode structures enabling reverse conduction H01L29/08D2)] [N9504]
H01L29/74B6	. . . . .	[N: the device being a field effect transistor (for turn-on or turn-off by field effect H01L29/745 , H01L29/749)] [N9504]
H01L29/74C	. . . . .	[N: having a built-in localised breakdown/breakover region, e.g. self-protected against destructive spontaneous, e.g. voltage breakover, firing] [N9504]
H01L29/74D	. . . . .	[N: having an amplifying gate structure, e.g. cascade (Darlington) configuration] [N9504]
H01L29/74E	. . . . .	[N: Asymmetrical thyristors (with a particular shorted anode structure H01L29/08D2)] [N9504]
H01L29/74F	. . . . .	[N: Lateral thyristors] [N9504]
H01L29/744	. . . . .	Gate-turn-off devices [N9504]
H01L29/745	. . . . .	with turn-off by field effect [N9504]
H01L29/745B	. . . . .	{7 dots} [N: produced by an insulated gate structure] [N9504]
H01L29/747	. . . . .	Bidirectional devices, e.g. triacs [C9504]
H01L29/749	. . . . .	with turn-on by field effect [N9504]

H01L29/76	. . .	Unipolar devices, [N: e.g. field effect transistors]
H01L29/76C	. . . .	[N: Transistor-like structures, e.g. hot electron transistor (HET); metal base transistor (MBT)]
H01L29/76D	. . . .	[N: Single electron transistors; Coulomb blockade devices (H01L29/788D takes precedence)] [N9605] [C0002]
H01L29/762	. . . .	Charge transfer devices [N9504]
H01L29/765	. . . . .	Charge-coupled devices [N: (peripheral circuits for CCD storage devices G11C19/28B2)] [N9504]
H01L29/768	. . . . .	with field effect produced by an insulated gate [N9504]
H01L29/768B	. . . . .	{7 dots} [N: Input structures] [N9504]
H01L29/768C	. . . . .	{7 dots} [N: Output structures] [N9504]
H01L29/768D	. . . . .	{7 dots} [N: Structures for regeneration, refreshing, leakage compensation or the like] [N9504]
H01L29/768E	. . . . .	{7 dots} [N: Buried channel CCD] [N9504]
H01L29/768E2	. . . . .	{8 dots} [N: Two-Phase CCD] [N9504]
H01L29/768E3	. . . . .	{8 dots} [N: Three-Phase CCD] [N9504]
H01L29/768E4	. . . . .	{8 dots} [N: Four-Phase CCD] [N9504]
H01L29/768F	. . . . .	{7 dots} [N: Surface Channel CCD] [N9504]
H01L29/768F2	. . . . .	{8 dots} [N: Two-Phase CCD] [N9504]
H01L29/768F3	. . . . .	{8 dots} [N: Three-Phase CCD] [N9504]
H01L29/768F4	. . . . .	{8 dots} [N: Four-Phase CCD] [N9504]
H01L29/772	. . . .	Field effect transistors [N9504]
H01L29/772B	. . . . .	[N: using static field induced regions, e.g. SIT, PBT] [N9504]
H01L29/772C	. . . . .	[N: with delta-doped channel (H01L29/778 takes precedence)] [N9504]
H01L29/772D	. . . . .	[N: Velocity modulation transistors, i.e. VMT][N9504]
H01L29/775	. . . . .	with one dimensional charge carrier gas channel, e.g. quantum wire FET [N9504]
H01L29/778	. . . . .	with two-dimensional charge carrier gas channel, e.g. HEMT; [N: with two-dimensional charge-carrier layer formed at a heterojunction interface (H01L29/804B4 takes precedence)] [N9504]
H01L29/778B	. . . . .	[N: with inverted single heterostructure, i.e. with active layer formed on top of wide bandgap layer, e.g. IHEMT] [N9504]
H01L29/778C	. . . . .	[N: with confinement of carriers by at least two heterojunctions, e.g. DHHEMT, quantum well HEMT, DHMODFET] [N9504]
H01L29/778C2	. . . . .	{7 dots} [N: using III-V semiconductor material] [N0201]
H01L29/778C2B	. . . . .	{8 dots} [N: with delta or planar doped donor layer (H01L29/778C2C takes precedence)] [N0201]
H01L29/778C2C	. . . . .	{8 dots} [N: with more than one donor layer] [N0201]
H01L29/778E	. . . . .	[N: with direct single heterostructure, i.e. with wide bandgap layer formed on top of active layer, e.g. direct single heterostructure MIS-like HEMT] [N9504]
H01L29/778E2	. . . . .	{7 dots} [N: with wide bandgap charge-carrier supplying layer, e.g. direct single heterostructure MODFET] [N9504]
H01L29/778F	. . . . .	[N: Vertical transistors] [N1201]
H01L29/778G	. . . . .	[N: the two-dimensional charge carrier gas being at least partially not parallel to a main surface of the semiconductor body] [N1201]

H01L29/78	. . . . .	with field effect produced by an insulated gate [N: (H01L29/772C , H01L29/775 , H01L29/778 take precedence)] [C9504]
H01L29/78B	. . . . .	[N: DMOS transistors, i.e. MISFETs with a channel accommodating body or base region adjoining a drain drift region (lateral high-voltage MISFETs with channel well and drain offset region H01L29/78F3)] [C0610]
H01L29/78B2	. . . . .	{7 dots} [N: Vertical DMOS transistors, i.e. VDMOS transistors] [C0610]
H01L29/78B2A	. . . . .	{8 dots} [N: structurally associated with at least one other device (assemblies H01L25/00; integrated circuits H01L27/00)] [N0610] [N: WARNING: This group and subgroups thereof are not complete, see provisionally also H01L29/78B2] [C0704]
H01L29/78B2A2	. . . . .	{9 dots} [N: the other device being a pn-junction diode] [N0610]
H01L29/78B2A2F	. . . . .	{10 dots} [N: in antiparallel, e.g. freewheel diode] [N0610]
H01L29/78B2A4	. . . . .	{9 dots} [N: the other device being a Schottky barrier diode] [N0610]
H01L29/78B2A6	. . . . .	{9 dots} [N: the other device being a breakdown diode, e.g. Zener diode] [N0610]
H01L29/78B2C	. . . . .	{8 dots} [N: having both source and drain contacts on the same surface, i.e. Up-Drain VDMOS transistors] [C0610]
H01L29/78B2D	. . . . .	{8 dots} [N: Inverted VDMOS transistors, i.e. Source-Down VDMOS transistors] [N0610]
H01L29/78B2E	. . . . .	{8 dots} [N: with an edge termination structure (guard regions per se H01L29/06B2B3B; field plates per se H01L29/40P)] [N0610] [N: WARNING: This group is not complete, see provisionally also H01L29/78B2, H01L29/78B2C and H01L29/78B2T] [C0704]
H01L29/78B2N	. . . . .	{8 dots} [N: with a substrate comprising an insulating layer, e.g. SOI-VDMOS transistors] [N0610]
H01L29/78B2T	. . . . .	{8 dots} [N: with trench gate electrode, e.g. U MOS transistors (trench gate electrodes per se H01L29/423D2B5T)] [N0610]
H01L29/78B2V	. . . . .	{8 dots} [N: with voltage or current sensing structure, e.g. emulator section, overcurrent sensing cell] [N0610] [N: WARNING: This group is not complete, see provisionally also H01L29/78B2, H01L29/78B2C and H01L29/78B2T] [C0704]
H01L29/78B4	. . . . .	{7 dots} [N: Lateral DMOS transistors, i.e. LDMOS transistors] [N0610] [N: WARNING: This group and subgroups thereof are not complete, see provisionally also H01L29/78B] [C0704]
H01L29/78B4A	. . . . .	{8 dots} [N: structurally associated with at least one other device (assemblies H01L25/00; integrated circuits H01L27/00)] [N0610]
H01L29/78B4A2	. . . . .	{9 dots} [N: the other device being a pn-junction diode] [N0610]
H01L29/78B4A2F	. . . . .	{10 dots} [N: in antiparallel, e.g. freewheel diode] [N0610]
H01L29/78B4A4	. . . . .	{9 dots} [N: the other device being a Schottky barrier diode] [N0610]
H01L29/78B4A6	. . . . .	{9 dots} [N: the other device being a breakdown diode, e.g. Zener diode] [N0610]
H01L29/78B4E	. . . . .	{8 dots} [N: with an edge termination structure (guard regions per se H01L29/06B2B3B; field plates per se H01L29/40P)] [N0610]

H01L29/78B4N	. . . . .	{8 dots} [N: with a substrate comprising an insulating layer, e.g. SOI-LDMOS transistors] [N0610]
H01L29/78B4T	. . . . .	{8 dots} [N: with trench gate electrode (trench gate electrodes per se H01L29/423D2B5T)] [N0610]
H01L29/78B4V	. . . . .	{8 dots} [N: with voltage or current sensing structure, e.g. emulator section, overcurrent sensing cell] [N0610]
H01L29/78C	. . . . .	[N: Vertical transistors (H01L29/78B2, H01L29/786C take precedence)] [C0610]
H01L29/78C2	. . . . .	{7 dots} [N: without inversion channel, e.g. vertical ACCUFETs, normally-on vertical MISFETs] [N0610] [N: WARNING: This group is not complete, see provisionally also H01L29/78C] [C0407]
H01L29/78D	. . . . .	[N: comprising a gate to body connection, i.e. bulk dynamic threshold voltage MOSFET (for thin film transistors H01L29/786B3 , H01L29/786H)] [N0201]
H01L29/78E	. . . . .	[N: with multiple gate structure (FinFETs or MuGFETs H01L29/78S6 , thin film transistors H01L29/786D)] [N9504] [C1009]
H01L29/78E2	. . . . .	{7 dots} [N: the structure comprising a MOS gate and at least one non-MOS gate, e.g. JFET or MESFET gate] [N9610] [C9611]
H01L29/78F	. . . . .	[N: with lightly doped drain or source extension, e.g. LDD MOSFET`s; DDD MOSFET`s (for thin film transistors H01L29/786B4)] [N9504]
H01L29/78F2	. . . . .	{7 dots} [N: with a non-planar structure, e.g. the gate or the source or the drain being non-planar]
		[N: Note Field oxide sunken in the substrate and not filling a groove is not an element characterising a non-planar structure]
H01L29/78F3	. . . . .	{7 dots} [N: with asymmetrical source and drain regions, e.g. lateral high-voltage MISFETs with drain offset region, extended drain MISFETs] [C0610]
H01L29/78F4	. . . . .	{7 dots} [N: with a significant overlap between the lightly doped extension and the gate electrode (H01L29/78F2 , H01L29/78F3 take precedence)] [N9609]
H01L29/78G	. . . . .	[N: without inversion channel, e.g. buried channel lateral MISFETs, normally-on lateral MISFETs, depletion-mode lateral MISFETs] [C0610]
H01L29/78H	. . . . .	[N: with Schottky drain or source contact] [N9504]
H01L29/78K	. . . . .	[N: the gate comprising a layer which is used for its ferroelectric properties] [N0010]
H01L29/78L	. . . . .	[N: with floating body, e.g. programmable transistors] [N0605]
H01L29/78R	. . . . .	[N: means for exerting mechanical stress on the crystal lattice of the channel region, e.g. using a flexible substrate (variation of the composition of the channel H01L29/10D2B4)][Warning: The groups H01L29/78R2 to H01L29/78R7 are not complete, see provisionally also H01L29/78R] [N1204]
H01L29/78R2	. . . . .	{7 dots} [N: the means being an applied insulating layer] [N1204]
H01L29/78R3	. . . . .	{7 dots} [N: the means being a conductive material, e.g. silicided S/D or Gate] [N1204]
H01L29/78R4	. . . . .	{7 dots} [N: the means being located in the lateral device isolation region, e.g. STI] [N1204] [M1207]
H01L29/78R5	. . . . .	{7 dots} [N: using a memorization technique, e.g. re-crystallization]

		under strain, bonding on a substrate having a thermal expansion coefficient different from the one of the region] [N1204]
H01L29/78R6	. . . . .	{7 dots} [N: the means being located in the source/drain region, e.g. SiGe source and drain] [N1204] [M1207]
H01L29/78R7	. . . . .	{7 dots} [N: the means being provided under the channel] [N1204]
H01L29/78S	. . . . .	[N: having a channel with a horizontal current flow in a vertical sidewall of a semiconductor body, e.g. FinFET, MuGFET] [N0810]
H01L29/78S2	. . . . .	{7 dots} [N: with the body tied to the substrate] [N0810]
H01L29/78S4	. . . . .	{7 dots} [N: the body having a non-rectangular crosssection] [N0810]
H01L29/78S4R	. . . . .	{8 dots} [N: with rounded corners] [N0810]
H01L29/78S6	. . . . .	{7 dots} [N: with at least two independent gates] [N1009]
H01L29/78S8	. . . . .	{7 dots} [N: with an non-uniform gate, e.g. varying doping structure, shape or composition on different sides of the fin, or different gate insulator thickness or composition on opposing fin sides (H01L29/78S6 takes precedence)] [N1009]
H01L29/786	. . . . .	Thin film transistors, [N: i.e. transistors with a channel being at least partly a thin film (transistors having only the source or the drain region on an insulator layer H01L29/06B3C2 ; thin film FinFETs H01L29/78S)] [C0810]
H01L29/786A	. . . . .	{7 dots} [N: characterised by the insulating substrate or support (H01L29/786E2B takes precedence)] [N9701]
H01L29/786B	. . . . .	{7 dots} [N: with supplementary region or layer in the thin film or in the insulated bulk substrate supporting it for controlling or increasing the safety of the device (H01L29/786C , H01L29/786D take precedence)] [N9504] [C9707]
H01L29/786B2	. . . . .	{8 dots} [N: for preventing leakage current (H01L29/786B4 takes precedence)] [N9504] [C9610]
H01L29/786B3	. . . . .	{8 dots} [N: for preventing the kink- or the snapback effect, e.g. discharging the minority carriers of the channel region for preventing bipolar effect] [N9504] [C9703]
H01L29/786B3C	. . . . .	{9 dots} [N: with a body contact] [N1204]
H01L29/786B4	. . . . .	{8 dots} [N: characterised by the drain or the source properties, e.g. the doping structure, the composition, the sectional shape or the contact structure (silicide contacts, electrodes in general H01L29/45S2)] [N9504] [C9703]
H01L29/786B4B	. . . . .	{9 dots} [N: with LDD structure or an extension or an offset region or characterised by the doping profile] [N9703]
H01L29/786B4B2	. . . . .	{10 dots} [N: the source and the drain regions being asymmetrical] [N9703]
H01L29/786B4B4	. . . . .	{10 dots} [N: with a significant overlap between the lightly doped drain and the gate electrode, e.g. GOLDD] [N1204]
H01L29/786B5	. . . . .	{8 dots} [N: with a light shield] [N9504]
H01L29/786B6	. . . . .	{8 dots} [N: with supplementary region or layer for improving the flatness of the device] [N9504]
H01L29/786B7	. . . . .	{8 dots} [N: with a drain or source connected to a bulk conducting substrate] [N9504]
H01L29/786C	. . . . .	{7 dots} [N: Vertical transistors] [N9504]
H01L29/786D	. . . . .	{7 dots} [N: with multiple gate] [N9504]

[N: Note

In groups [H01L29/786E](#) to [H01L29/786H](#), the materials specified for the transistors are the material of the channel region]

H01L29/786D2	. . . . .	{8 dots} [N: arranged on opposing sides of the channel] [N1204]
H01L29/786E	. . . . .	{7 dots} [N: Silicon transistors (H01L29/786B to H01L29/786D take precedence)] [N9504]
H01L29/786E2	. . . . .	{8 dots} [N: Monocrystalline silicon transistors] [N9504]
H01L29/786E2B	. . . . .	{9 dots} [N: SOS transistors] [N9504]
H01L29/786E4	. . . . .	{8 dots} [N: Non-monocrystalline silicon transistors] [N9504]
H01L29/786E4B	. . . . .	{9 dots} [N: Amorphous silicon transistors] [N9504]
H01L29/786E4B2	. . . . .	{10 dots} [N: with normal-type structure, e.g. with top gate] [N9504]
H01L29/786E4B4	. . . . .	{10 dots} [N: with inverted-type structure, e.g. with bottom gate] [N9504]
H01L29/786E4C	. . . . .	{9 dots} [N: Polycrystalline or microcrystalline silicon transistor] [N9504]
H01L29/786E4C2	. . . . .	{10 dots} [N: with normal-type structure, e.g. with top gate] [N9504]
H01L29/786E4C4	. . . . .	{10 dots} [N: with inverted-type structure, e.g. with bottom gate] [N9504]
H01L29/786F	. . . . .	{7 dots} [N: having a semiconductor body comprising AIII-BV or All-BVI or AIV-BVI semiconductor materials, or Se or Te] [N9504] [C0612]
H01L29/786G	. . . . .	{7 dots} [N: having a semiconductor body comprising semiconductor materials of the fourth group not being silicon, or alloys including an element of the group IV, e.g. Ge, SiN alloys, SiC alloys (H01L29/786K takes precedence)] [N9504]
H01L29/786G2	. . . . .	{8 dots} [N: with a multilayer structure or superlattice structure] [N9504]
H01L29/786K	. . . . .	{7 dots} [N: having a semiconductor body comprising an oxide semiconductor material, e.g. zinc oxide, copper aluminium oxide, cadmium stannate] [N0612]
H01L29/786K2	. . . . .	{8 dots} [N: the semiconducting oxide being amorphous] [N1204]
H01L29/786S	. . . . .	{7 dots} [N: characterised by the structure of the channel, e.g. multichannel, transverse or longitudinal shape, length or width, doping structure, or the overlap or alignment between the channel and the gate, the source or the drain, or the contacting structure of the channel (H01L29/786B3 takes precedence; transistors having a drain offset region or a lightly doped drain (LDD) H01L29/786B4B)] [N0612]
H01L29/788	. . . . .	with floating gate [N: (H01L29/78K takes precedence)] [C0010]
H01L29/788B	. . . . .	{7 dots} [N: Programmable transistors with only two possible levels of programming (H01L29/788D takes precedence)] [C0002]
H01L29/788B2	. . . . .	{8 dots} [N: charging by injection of carriers through a conductive insulator, e.g. Poole-Frankel conduction]
H01L29/788B4	. . . . .	{8 dots} [N: charging by tunnelling of carriers, e.g. Fowler-Nordheim tunnelling]

H01L29/788B6	. . . . .	{8 dots} [N: charging by hot carrier injection]
H01L29/788B6B	. . . . .	{9 dots} [N: Hot carrier injection from the channel]
H01L29/788B6C	. . . . .	{9 dots} [N: Hot carrier produced by avalanche breakdown of a PN junction, e.g. FAMOS]
H01L29/788C	. . . . .	{7 dots} [N: Programmable transistors with more than two possible different levels of programming]
H01L29/788D	. . . . .	{7 dots} [N: Transistors programmable by two single electrons] [N0002]
H01L29/788V	. . . . .	{7 dots} [N : Vertical transistors, i.e. transistors having source and drain not in the same horizontal plane] [N1107]
H01L29/792	. . . . .	with charge trapping gate insulator, e.g. MNOS-memory transistors
H01L29/792B	. . . . .	{7 dots} [N: Programmable transistors with more than two possible different levels of programming] [N0205]
H01L29/792V	. . . . .	{7 dots} [N: Vertical transistors, i.e. transistors having source and drain not in the same horizontal plane] [N1107]
H01L29/80	. . . . .	with field effect produced by a PN or other rectifying junction gate, [N: i.e. potential-jump barrier] [C9504]
H01L29/80B	. . . . .	[N: with heterojunction gate, e.g. transistors with semiconductor layer acting as gate insulating layer, MIS-like transistors (H01L29/80C takes precedence; with one dimensional electron gas H01L29/775 ; with dimensional electron gas H01L29/778)] [C9607]
H01L29/80B2	. . . . .	{7 dots} [N: Programmable transistors, e.g. with charge-trapping quantum well] [N9504]
H01L29/80C	. . . . .	[N: with Schottky drain or source contact] [N9607]
H01L29/808	. . . . .	with a PN junction gate, [N: e.g. PN homojunction gate (H01L29/772C , H01L29/775 , H01L29/778 , H01L29/80C take precedence)] [C9607]
H01L29/808B	. . . . .	{7 dots} [N: Vertical transistors (SIT H01L29/772B)] [C9504]
H01L29/808C	. . . . .	{7 dots} [N: Thin film JFET`s]
H01L29/812	. . . . .	with a Schottky gate [N: (H01L29/772C , H01L29/775 , H01L29/778 , H01L29/80C take precedence; with Schottky contact on top of heterojunction gate H01L29/80B)] [C9607]
H01L29/812B	. . . . .	{7 dots} [N: Vertical transistors (SIT , PBT H01L29/772B)] [C9504]
H01L29/812C	. . . . .	{7 dots} [N: with multiple gate]
H01L29/812D	. . . . .	{7 dots} [N: Thin film MESFET`s]
H01L29/812E	. . . . .	{7 dots} [N: with recessed gate]
H01L29/82	. . . . .	controllable by variation of the magnetic field applied to the device [C9504]
H01L29/84	. . . . .	controllable by variation of applied mechanical force, e.g. of pressure [C9504]
H01L29/86	. . . . .	controllable only by variation of the electric current supplied, or only the electric potential applied, to one or more of the electrodes carrying the current to be rectified, amplified, oscillated or switched [C9504]
H01L29/8605	. . . . .	Resistors with PN junctions [N9504]
H01L29/861	. . . . .	Diodes [N9504]
H01L29/861B	. . . . .	[N: Planar PN junction diodes] [N9504]
H01L29/861C	. . . . .	[N: Mesa PN junction diodes] [N9504]
H01L29/861E	. . . . .	[N: Hi-lo semiconductor devices, e.g. memory devices] [N9504]
H01L29/861F	. . . . .	[N: Charge trapping diodes] [N9504]

H01L29/861P	. . . .	[N: Diodes with bulk potential barrier, e.g. Camel diodes, Planar Doped Barrier diodes, Graded bandgap diodes] [N9504]
H01L29/862	. . . .	Point contact diodes [N9504]
H01L29/864	. . . .	Transit-time diodes, e.g. IMPATT, TRAPATT diodes [N9504]
H01L29/866	. . . .	Zener diodes [N9504]
H01L29/868	. . . .	PIN diodes [N9504]
H01L29/87	. . . .	Thyristor diodes, e.g. Shockley diodes, break-over diodes [N9504]
H01L29/872	. . . .	Schottky diodes
H01L29/872T	. . . . .	[N: of the trench MOS barrier type [TMBS]] [N1201]
H01L29/88	. . . .	Tunnel-effect diodes [C9504]
H01L29/88R	. . . . .	[N: Resonant tunneling diodes, i.e. RTD, RTBD]
H01L29/885	. . . . .	Esaki diodes [N9504]
H01L29/92	. . . .	Capacitors with potential-jump barrier or surface barrier
H01L29/93	. . . .	Variable capacitance diodes, e.g. varactors
H01L29/94	. . . .	Metal-insulator-semiconductors, e.g. MOS
H01L29/94B	. . . . .	[N: Trench capacitors]

H01L31/00

Semiconductor devices sensitive to infra-red radiation, light, electromagnetic radiation of shorter wavelength or corpuscular radiation and adapted either for the conversion of the energy of such radiation into electrical energy or for the control of electrical energy by such radiation; Processes or apparatus peculiar to the manufacture or treatment thereof or of parts thereof; Details thereof ([H01L51/42](#) takes precedence; devices consisting of a plurality of solid state components formed in, or on, a common substrate, other than combinations of radiation-sensitive components with one or more electric light sources, [H01L27/00](#); production of heat using solar heat [F24J2/00](#); measurement of X-radiation, gamma radiation, corpuscular radiation or cosmic radiation with semiconductor detectors [G01T1/24](#), with resistance detectors [G01T1/26](#); measurement of neutron radiation with semiconductor detectors [G01T3/08](#); couplings of light guides with optoelectronic elements [G02B6/42](#); obtaining energy from radioactive sources [G21H](#)) [C9907]

H01L31/02	. Details
H01L31/02E	. . [N: Arrangements for conducting electric current to or from the device in operations]
H01L31/02E2	. . . [N: for device characterised by at least one potential jump barrier or surface barrier]
H01L31/02E2B	. . . . [N: for solar cells or solar cell modules] [C1204]
H01L31/02E2B2	. . . . . [N: comprising specially adapted module bus-bar structures] [N1204]
H01L31/02E2B3	. . . . . [N: comprising output lead wires elements] [N1204]
H01L31/02H	. . [N: Circuit arrangements of general character for the devices]
H01L31/02H2	. . . [N: for devices characterised by at least one potential jump barrier or surface barrier]
H01L31/02H2B	. . . . [N: for solar cells]
H01L31/02H2C	. . . . [N: Position sensitive and lateral effect photodetectors; Quadrant photodiodes]
H01L31/02H2D	. . . . [N: for devices working in avalanche mode]
H01L31/0203	. . Containers; Encapsulations, [N: e.g. encapsulation of photodiodes (encapsulation or housing for solar cells H01L31/048)] [C1204]

- H01L31/0216 . . Coatings
- H01L31/0216B . . . [N: for devices characterised by at least one potential jump barrier or surface barrier]
- H01L31/0216B2 [N: for filtering or shielding light, e.g. multicolour filters for photodetectors]
- H01L31/0216B2B [N: for shielding light, e.g. light blocking layers, cold shields for infra-red detectors]
- H01L31/0216B2C [N: using interference filters, e.g. multilayer dielectric filters (**interference filters G02B5/28**)]
- H01L31/0216B3 [N: for solar cells]
- H01L31/0216B3B [N: the coatings being antireflective or having enhancing optical properties for the solar cells]
- H01L31/0224 . . Electrodes
- H01L31/0224B . . . [N: for devices characterised by at least one potential jump barrier or surface barrier]
- H01L31/0224B1 [N: comprising ring electrodes] [N1204]
- H01L31/0224B2 [N: for solar cells]
- H01L31/0224B2B [N: Particular geometry of the grid contacts]
- H01L31/0224B2C [N: Electrode arrangements specially adapted for back-contact solar cells] [N1204]
- H01L31/0224B2C2 [N: for metallisation wrap-through [MWT] type solar cells] [N1204]
- H01L31/0224B2C3 [N: for emitter wrap-through [EWT] type solar cells, e.g. interdigitated emitter-base back-contacts] [N1204]
- H01L31/0224C . . . [N: made of transparent conductive layers, e.g. TCO, ITO layers]
- H01L31/0224C2 [N: composed of indium tin oxide [ITO]] [N1204]
- H01L31/0224C3 [N: composed of zinc oxide [ZnO]] [N1204]
- H01L31/0224C4 [N: composed of a thin transparent metal layer, e.g. gold] [N1204]
- H01L31/0232 . . Optical elements or arrangements associated with the device [N: (**optical elements or arrangements for solar cells H01L31/052B**)] [C1204]
- H01L31/0232C . . . [N: comprising luminescent members, e.g. fluorescent sheets upon the device]
- H01L31/0232D . . . [N: the optical elements not being integrated nor being directly associated with the device] [N1204]
- H01L31/0232E . . . [N: the optical elements being integrated or being directly associated to the device, e.g. back reflectors (**optical coatings H01L31/0216**)] [N1204]
- H01L31/0236 . . Special surface textures
- H01L31/0236B . . . [N: of the semiconductor body itself, e.g. textured active layers] [N1204]
- H01L31/0236C . . . [N: of the substrate or of a layer on the substrate, e.g. textured ITO/glass substrate or superstrate, textured polymer layer on glass substrate] [N1204]
- H01L31/024 . . Arrangements for cooling, heating, ventilating or temperature compensation [N: (**cooling arrangements for solar cells H01L31/052**)]
- H01L31/0248 . characterised by their semiconductor bodies
- H01L31/0256 . . characterised by the material
- H01L31/0264 . . . Inorganic materials
- H01L31/0272 Selenium or tellurium
- H01L31/0272C [N: characterised by the doping material]
- H01L31/028 including, apart from doping material or other impurities, only elements of the

fourth group of the Periodic System

H01L31/028P	. . . . .	[N: comprising porous silicon as part of the active layer(s) (porous silicon as antireflective layer for photodiodes H01L31/0216 ; for solar cells H01L31/0216B3B)] [N0004]
H01L31/0288	. . . . .	characterised by the doping material
H01L31/0296	. . . . .	including, apart from doping material or other impurities, only AIIIVI compounds, e.g. CdS, ZnS, HgCdTe
H01L31/0296A	. . . . .	[N: characterised by the doping material] [N1204]
H01L31/0296C	. . . . .	[N: including ternary compounds, e.g. HgCdTe]
H01L31/0304	. . . . .	including, apart from doping materials or other impurities, only AIIBV compounds
H01L31/0304A	. . . . .	[N: characterised by the doping material] [N1204]
H01L31/0304D	. . . . .	[N: comprising a nitride compounds, e.g. GaN] [N1204]
H01L31/0304E	. . . . .	[N: including ternary or quaternary compounds, e.g. GaAlAs, InGaAs, InGaAsP] [N1204]
H01L31/0304E2	. . . . .	[N: comprising a nitride compounds, e.g. InGaN] [N1204]
H01L31/0312	. . . . .	including, apart from doping materials or other impurities, only AIVBIV compounds, e.g. SiC
H01L31/0312C	. . . . .	[N: characterised by the doping material]
H01L31/032	. . . . .	including, apart from doping materials or other impurities, only compounds not provided for in groups H01L31/0272 to H01L31/0312
H01L31/032B	. . . . .	[N: characterised by the doping material (H01L31/032C2 , H01L31/032D2 take precedence)]
H01L31/032C	. . . . .	[N: comprising only AIBIIICVI chalcopyrite compounds, e.g. Cu In Se ₂ , Cu Ga Se ₂ , Cu In Ga Se ₂]
H01L31/032C2	. . . . .	[N: characterised by the doping material]
H01L31/032D	. . . . .	[N: comprising only AIVBVI or AIIBIVCVI chalcogenide compounds, e.g. Pb Sn Te]
H01L31/032D2	. . . . .	[N: characterised by the doping material]
H01L31/032E	. . . . .	[N: comprising AIBIICIVDVI kesterite compounds, e.g. Cu ₂ ZnSnSe ₄ , Cu ₂ ZnSnS ₄] [N1204]
H01L31/032E2	. . . . .	[N: characterised by the doping material] [N1204]
H01L31/0328	. . . . .	including, apart from doping materials or other impurities, semiconductor materials provided for in two or more of groups H01L31/0272 to H01L31/032
H01L31/0336	. . . . .	in different semiconductor regions, e.g. Cu ₂ X / CdX hetero-junctions, X being an element of the sixth group of the Periodic System
H01L31/0336B	. . . . .	[N: comprising only Cu ₂ X / CdX heterojunctions, X being an element of the sixth group of the Periodic System]
H01L31/0352	. . . . .	characterised by their shape or by the shapes, relative sizes or disposition of the semiconductor regions
H01L31/0352A	. . . . .	[N: comprising a quantum structures] [N1204]
H01L31/0352A2	. . . . .	[N: the quantum structure being quantum dots] [N1204]
H01L31/0352A3	. . . . .	[N: the quantum structure being quantum wires, or nano-rods (carbon nano-tubes H01L51/00M4D)] [N1204]
H01L31/0352B	. . . . .	[N: Superlattices; Multiple quantum well structures]
H01L31/0352B2	. . . . .	[N: characterised by amorphous semiconductor layers]
H01L31/0352B3	. . . . .	[N: including, apart from doping materials or other impurities, only elements

- H01L31/0352B4 of the fourth group of the Periodic System, e.g. Si-SiGe superlattices]
- H01L31/0352C [N: Doping superlattices, e.g. nipi superlattices]
- H01L31/0352C2 [N: characterised by at least one potential jump barrier or surface barrier]
- H01L31/0352C3 [N: Shape of the body]
- H01L31/036 . . characterised by their crystalline structure or particular orientation of the crystalline planes
- H01L31/0368 . . . including polycrystalline semiconductors ([H01L31/0392](#) takes precedence)
- H01L31/0368B [N: including only elements of the fourth group of the Periodic System]
- H01L31/0368B2 [N: including microcrystalline silicon, uc-Si] [N9910]
- H01L31/0368B3 [N: including microcrystalline AIVBIV alloys, e.g. uc-SiGe, uc-SiC] [N9910]
- H01L31/0376 . . . including amorphous semiconductors([H01L31/0392](#)takes precedence)
- H01L31/0376B [N: including only elements of the fourth group of the Periodic System]
- H01L31/0376B2 [N: including AIVBIV compounds or alloys, e.g. SiGe, SiC]
- H01L31/0376B3 [N: presenting light-induced characteristic variations, e.g. Staebler-Wronski effect]
- H01L31/0384 . . . including other non-monocrystalline materials, e.g. semiconductor particles embedded in an insulating material ([H01L31/0392](#) takes precedence)
- H01L31/0384B [N: comprising semiconductor nano-particles embedded in a semiconductor matrix (in insulating matrix [H01L31/0384](#))] [N1204]
- H01L31/0392 . . . including thin films deposited on metallic or insulating substrates; [N: characterised by specific substrate materials or substrate features or by the presence of intermediate layers, e.g. barrier layers, on the substrate ([textured substrates H01L31/0236C](#))] [C1204]
- H01L31/0392B [N: including only elements of the fourth group of the Periodic System]
- H01L31/0392C [N: including AIBIIICVI compound materials, e.g. CIS, CIGS] [N1204]
- H01L31/0392D [N: including AIBVI compound materials, e.g. CdTe, CdS] [N1204]
- H01L31/0392E [N: comprising a flexible substrate] [N1204]
- H01L31/0392E2 [N: including AIBIIICVI compound, e.g. CIS, CIGS deposited on metal or polymer foils] [N1204]
- H01L31/04 . . adapted as conversion devices
- H01L31/04B . . [N: Thermophotovoltaic systems]
- H01L31/04C . . [N: specially adapted for preventing damage caused by radiation, ([H01L31/0216](#) takes precedence)]
- H01L31/042 . . including a panel or array of photoelectric cells, e.g. solar cells
- H01L31/042B . . . [N: characterised by the supporting structure or by the frame structure ([H01L31/045](#) takes precedence)] [C1208]
- H01L31/042B2 [N: characterised by the frame structure of the solar panel] [N1204]
- H01L31/042C [N: specially adapted to be used in motorway sound barriers] [N9610]
- H01L31/042D [N: comprising DC/AC inverter means associated with the panel itself, e.g. AC module ([DC/AC inverters per se H02M](#))] [N9908] [C9909]
- H01L31/045 . . . collapsible or foldable
- H01L31/048 . . . encapsulated or with housing
- H01L31/048A [N: characterised by the composition of the encapsulation material] [N1204]

- H01L31/048B [N: specially adapted for house roof structures, e.g. roof tile elements] [N0210]
- H01L31/048B2 [N: Roof tile elements] [N0210]
- H01L31/048B3 [N: specially adapted for flat roofs] [N1204]
- H01L31/048C [N: comprising specially adapted electrical connection means to the solar panel, e.g. junction boxes] [N0210]
- H01L31/048C2 [N: with cooling means associated with the electrical connection means, e.g. cooling means associated with or applied to the junction box (cooling means for solar cells or solar cell modules [H01L31/052](#))] [N1204]
- H01L31/048D [N: Protective back-sheets] [N1204]
- H01L31/048E [N: Double glass encapsulation, e.g. photovoltaic cells arranged between front and rear glass sheets] [N1204]
- H01L31/05 . . . characterised by special interconnection means; [N: comprising interconnection means for series or parallel connection of solar cells in a module, or for electrical interconnection of two or more solar cell modules] [C1204]
- H01L31/05B [N: specially adapted for series or parallel connection of solar cells in a module] [N1204]
- H01L31/05B2 [N: the interconnection means having a particular shape] [N1204]
- H01L31/05B3 [N: made of a particular material or composition of materials] [N1204]
- H01L31/05B4 [N: specially adapted for interconnection of back-contact solar cells] [N1204]
- H01L31/052 . . . with cooling, light-reflecting or light-concentrating means [N: with passive cooling means, e.g. heatsinks] [C1208]
- H01L31/052A [N: using a gaseous or a liquid coolant, e.g. air flow ventilation, water circulation] [N1204]
- H01L31/052B [N: light reflecting or light concentrating means for solar cells or solar cells modules] [C1204]
- H01L31/052B2 [N: comprising light concentrating means of the refractive type, e.g. lenses] [N1204]
- H01L31/052B3 [N: comprising light concentrating means of the reflecting type, e.g. parabolic mirrors, concentrators using total internal reflection] [N1204]
- H01L31/052B4 [N: comprising light reflecting layers integrated to the solar cell, e.g. of the back surface reflector [BSR] type] [C1204]
- H01L31/052B5 [N: comprising spectrum splitting means, e.g. dichroic mirrors] [N1204]
- H01L31/055 where light is absorbed and re-emitted at a different wavelength by the concentrator, e.g. by using luminescent material
- H01L31/058 . . . including means to utilise heat energy, e.g. hybrid systems, or a supplementary source of electric energy (using solar heat per se [F24J2/00](#)); [N: Photovoltaic systems comprising special energy storage means]
- H01L31/058B [N: using a supplementary source of electric energy, e.g. hybrid wind-photovoltaic, thermoelectric-photovoltaic or diesel-photovoltaic energy systems] [C1204]
- H01L31/058C [N: comprising special energy storage means]
- H01L31/06 . . characterised by at least one potential-jump barrier or surface barrier [C1105]
- [N: **Notes**[N1105]
Groups [H01L31/061](#) to 31/078 are based on IPC2012.01
]
- H01L31/061 . . . the potential barriers being of the point-contact type ([H01L31/07](#) takes precedence) [N1105]

- H01L31/062 . . . the potential barriers being only of the metal-insulator-semiconductor type
- H01L31/065 . . . the potential barriers being only of the graded gap type
- H01L31/068 . . . the potential barriers being only of the PN homojunction type, e.g. bulk silicon PN homojunction solar cells or thin film polycrystalline silicon PN homojunction solar cells [C1105]
- H01L31/068B [N: back-junction, i.e. rearside emitter, solar cells, e.g. interdigitated base-emitter regions back-junction cells] [N1204]
- H01L31/068C [N: double emitter cells, e.g. bifacial solar cells] [N1204]
- H01L31/0687 Multiple junction or tandem solar cells [N1105]
- H01L31/0687B [N: inverted grown metamorphic [IMM] multiple junction solar cells, e.g. III-V compounds inverted metamorphic multi-junction cells] [N1204]
- H01L31/0693 the devices including, apart from doping material or other impurities, only AIIIBV compounds, e.g. GaAs or InP solar cells [N1105]
- H01L31/07 . . . the potential barriers being only of the Schottky type
- H01L31/072 . . . the potential barriers being only of the PN heterojunction type
- H01L31/0725 Multiple junction or tandem solar cells [N1105]
- H01L31/073 comprising only AIBVI compound semiconductors, e.g. CdS/CdTe solar cells [N1105]
- H01L31/0735 comprising only AIIIBV compound semiconductors, e.g. GaAs/AlGaAs or InP/GaInAs solar cells [N1105]
- H01L31/074 comprising a heterojunction with an element of the fourth group of the Periodic System, e.g. ITO/Si, GaAs/Si or CdTe/Si solar cells [N1105]
- H01L31/0745 comprising a AIVBIV heterojunction, e.g. Si/Ge, SiGe/Si or Si/SiC solar cells [N1105]
- H01L31/0747 comprising a heterojunction of crystalline and amorphous materials, e.g. heterojunction with intrinsic thin layer or HIT® solar cells [N1105] [M1201]
- H01L31/0749 including a AIBIIICVI compound, e.g. CdS/CuInSe₂ [CIS] heterojunction solar cells [N1105]
- H01L31/075 . . . the potential barriers being only of the PIN type
- H01L31/076 Multiple junction or tandem solar cells [N1105]
- H01L31/077 the devices comprising monocrystalline or polycrystalline materials [N1105]
- H01L31/078 . . . including different types of potential barriers provided for in two or more of groups [H01L31/062](#) to [H01L31/075](#) [C1105]
- H01L31/08 . . in which radiation controls flow of current through the device, e.g. photoresistors
- H01L31/08C . . . [N: the device being sensitive to very short wavelength, e.g. X-ray, Gamma-rays]
- H01L31/09 . . . Devices sensitive to infra-red, visible or ultraviolet radiation ([H01L31/101](#) takes precedence)
- H01L31/09B [N: comprising amorphous semiconductors]
- H01L31/10 . . . characterised by at least one potential-jump barrier or surface barrier, e.g. phototransistors
- H01L31/101 Devices sensitive to infra-red, visible or ultra-violet radiation
- H01L31/101B [N: devices sensitive to two or more wavelengths, e.g. multi-spectrum radiation detection devices] [N1204]
- H01L31/101C [N: comprising transparent or semitransparent devices] [N1204]
- H01L31/102 characterised by only one potential barrier or surface barrier

H01L31/102B	. . . . .	[N: the potential barrier being of the point contact type]
H01L31/103	. . . . .	the potential barrier being of the PN homojunction type
H01L31/103B	. . . . .	[N: the devices comprising active layers formed only by AIIIBVI compounds, e.g. HgCdTe IR photodiodes]
H01L31/103C	. . . . .	[N: the devices comprising active layers formed only by AIIIBV compounds]
H01L31/103D	. . . . .	[N: the devices comprising active layers formed only by AIVBVI compounds]
H01L31/105	. . . . .	the potential barrier being of the PIN type
H01L31/105B	. . . . .	[N: the devices comprising amorphous materials of the fourth group of the Periodic System]
H01L31/107	. . . . .	the potential barrier working in avalanche mode, e.g. avalanche photodiode
H01L31/107B	. . . . .	[N: in which the active layers, e.g. absorption or multiplication layers, form a heterostructure, e.g. SAM structure]
H01L31/108	. . . . .	the potential barrier being of the Schottky type
H01L31/108B	. . . . .	[N: the devices being of the Metal-Semiconductor-Metal (MSM) Schottky barrier type]
H01L31/109	. . . . .	the potential barrier being of the PN heterojunction type
H01L31/11	. . . . .	characterised by two potential barriers or surface barriers, e.g. bipolar phototransistor
H01L31/11B	. . . . .	[N: the device being a bipolar phototransistor]
H01L31/111	. . . . .	characterised by at least three potential barriers, e.g. photothyristor
H01L31/111B	. . . . .	[N: the device being a photothyristor]
H01L31/111B2	. . . . .	[N: of the static induction type]
H01L31/112	. . . . .	characterised by field-effect operation, e.g. junction field-effect phototransistor
H01L31/112B	. . . . .	[N: Devices with Schottky gate]
H01L31/112B2	. . . . .	[N: the device being a CCD device]
H01L31/112B3	. . . . .	[N: the device being a photo MESFET]
H01L31/112C	. . . . .	[N: Devices with PN homojunction gate]
H01L31/112C2	. . . . .	[N: the device being a CCD device]
H01L31/112C3	. . . . .	[N: the device being a field-effect phototransistor]
H01L31/112D	. . . . .	[N: Devices with PN heterojunction gate]
H01L31/112D2	. . . . .	[N: the device being a CCD device]
H01L31/112D3	. . . . .	[N: the device being a field-effect phototransistor]
H01L31/113	. . . . .	being of the conductor-insulator-semiconductor type, e.g. metal-insulator-semiconductor field-effect transistor
H01L31/113B	. . . . .	[N: the device being a conductor-insulator-semiconductor diode or a CCD device]
H01L31/113C	. . . . .	[N: the device being a metal-insulator-semiconductor field-effect transistor]
H01L31/115	. . . . .	Devices sensitive to very short wavelength, e.g. X-rays, gamma-rays or corpuscular radiation
H01L31/117	. . . . .	of the bulk effect radiation detector type, e.g. Ge-Li compensated PIN gamma-ray detectors

- H01L31/117B [N: Li compensated PIN gamma-ray detectors]
- H01L31/118 of the surface barrier or shallow PN junction detector type, e.g. surface barrier alpha-particle detectors
- H01L31/118B [N: of the shallow PN junction detector type]
- H01L31/119 characterised by field-effect operation, e.g. MIS type detectors

- H01L31/12 Structurally associated with, e.g. formed in or on a common substrate with, one or more electric light sources, e.g. electroluminescent light sources, and electrically or optically coupled thereto (semiconductor devices with at least one potential barrier or surface barrier adapted for light emission [H01L33/00](#); amplifiers using electroluminescent element and photocell [H03F17/00](#); electroluminescent light sources per se [H05B33/00](#))

- H01L31/12B [N: Composite devices with photosensitive elements and electroluminescent elements within one single body]
- H01L31/14 the light source or sources being controlled by the semiconductor device sensitive to radiation, e.g. image converters, image amplifiers, image storage devices
- H01L31/14B [N: the semiconductor device sensitive to radiation being without a potential-jump barrier or surface barrier]
- H01L31/14B2 [N: the light source being a semiconductor device with at least one potential-jump barrier or surface barrier, e.g. light emitting diode]
- H01L31/14C [N: the semiconductor device sensitive to radiation being characterised by at least one potential-jump barrier or surface barrier]
- H01L31/147 the light sources and the devices sensitive to radiation all being semiconductor devices characterised by at least one potential or surface barrier
- H01L31/153 formed in, or on, a common substrate
- H01L31/16 the semiconductor device sensitive to radiation being controlled by the light source or sources
- H01L31/16B [N: Semiconductor device sensitive to radiation without a potential-jump or surface barrier, e.g. photoresistors]
- H01L31/16B2 [N: the light source being a semiconductor device with at least one potential-jump barrier or surface barrier e.g. a light emitting diode]
- H01L31/16B4 [N: Optical potentiometers]
- H01L31/16C [N: the semiconductor sensitive to radiation being characterised by at least one potential-jump or surface barrier]
- H01L31/167 the light sources and the devices sensitive to radiation all being semiconductor devices characterised by at least one potential or surface barrier
- H01L31/173 formed in, or on, a common substrate

- H01L31/18 Processes or apparatus peculiar to the manufacture or treatment of these devices or of parts thereof (not peculiar thereto [H01L21/00](#))
- H01L31/18C [N: comprising only elements of the fourth group of the Periodic System]
- H01L31/18C2 [N: including only Ge]
- H01L31/18C4 [N: including only AIVBIV alloys, e.g. SiGe]
- H01L31/18C4B [N: Special manufacturing methods for microcrystalline layers, e.g. uc-SiGe, uc-SiC] [N9910]
- H01L31/18C5 [N: Special manufacturing methods for polycrystalline Si, e.g. Si ribbon, poly Si ingots, thin films of polycrystalline Si]
- H01L31/18C5B [N: Special manufacturing methods for microcrystalline Si, uc-Si] [N9910]
- H01L31/18D [N: the active layers comprising only AIIIVI compounds, e.g. CdS, ZnS, CdTe]

- H01L31/18D2 . . . [N: comprising ternary compounds, e.g. Hg Cd Te]
- H01L31/18D3 . . . [N: comprising a growth substrate not being an AIIIBVI compound] [C1204]
- H01L31/18E . . . [N: the active layers comprising only AIIIBV compounds, e.g. GaAs, InP]
- H01L31/18E2 . . . [N: comprising ternary or quaternary compounds, e.g. Ga Al As, In Ga As P]
- H01L31/18E2B [N: comprising nitride compounds, e.g. InGaN, InGaAlN] [N1204]
- H01L31/18E3 . . . [N: comprising a growth substrate not being an AIIIBV compound] [C1204]
- H01L31/18E4 . . . [N: comprising nitride compounds, e.g. GaN] [N1204]
- H01L31/18G . . . [N: Particular post-treatment for the devices, e.g. annealing, impurity gettering, short-circuit elimination, recrystallisation]
- H01L31/18G2 . . . [N: Annealing] [N0103]
- H01L31/18G3 . . . [N: Passivation] [N0103]
- H01L31/18G4 . . . [N: Recrystallisation] [N0204]
- H01L31/18H . . . [N: Particular processes or apparatus for batch treatment of the devices]
- H01L31/18H2 . . . [N: Apparatus specially adapted for automatic interconnection of solar cells in a module] [N9610]
- H01L31/18J . . . [N: Manufacture of transparent electrodes, e.g. TCO, ITO]
- H01L31/18J2 . . . [N: methods for etching transparent electrodes] [N1204]
- H01L31/18R . . . [N: methods involving the use of temporary, removable substrates] [N1204]
- H01L31/18R2 . . . [N: for thin-film semiconductors] [N1204]
- H01L31/20 . . . such devices or parts thereof comprising amorphous semiconductor materials
- H01L31/20B [N: including only elements of the fourth group of the Periodic System]
- H01L31/20B2 [N: including AIVBIV alloys, e.g. SiGe, SiC]
- H01L31/20C . . . [N: Particular processes or apparatus for continuous treatment of the devices, e.g. roll-to roll processes, multi-chamber deposition] [C1204]
- H01L31/20D . . . [N: Particular post-treatment of the devices, e.g. annealing, short-circuit elimination]

H01L33/00

Semiconductor devices with at least one potential-jump barrier or surface barrier specially adapted for light emission; Processes or apparatus specially adapted for the manufacture or treatment thereof or of parts thereof; Details thereof ([H01L51/50](#) takes precedence; devices consisting of a plurality of semiconductor components formed in or on a common substrate and including semiconductor components with at least one potential-jump barrier or surface barrier, specially adapted for light emission [H01L27/15](#); semiconductor lasers [H01S5/00](#)) [C1112]

Notes [C1112]

1. This group covers light emitting diodes [LEDs] or superluminescent diodes [SLDs], including LEDs or SLDs emitting infra-red [IR] light or ultra-violet [UV] light. 2. In this group, at each hierarchical level, in the absence of an indication to the contrary, classification is made in the first appropriate place.

- H01L33/00D . . . [N: Devices characterised by their operation]
- H01L33/00D2 . . . [N: having p-n or hi-lo junctions]
- H01L33/00D2B [N: p-i-n devices]
- H01L33/00D2C [N: having at least two p-n junctions]
- H01L33/00D3 . . . [N: having heterojunctions or graded gap]
- H01L33/00D3B [N: comprising only AIIIBV compounds]

- H01L33/00D3C . . . [N: comprising only AlIBVI compounds]
- H01L33/00D4 . . [N: having Schottky barriers]
- H01L33/00D5 . . [N: having a MIS barrier layer]
- H01L33/00D6 . . [N: characterised by field-effect operation]
- H01L33/00D7 . . [N: the devices being superluminescent diodes]

- H01L33/00G . [N: Processes] [C0301]
- H01L33/00G2 . . [N: for devices with an active region comprising only group IV elements] [C0301]
- H01L33/00G2B . . . [N: comprising amorphous semiconductors]
- H01L33/00G3 . . [N: for devices with an active region comprising only III-V compounds] [C0301]
- H01L33/00G3B . . . [N: with a substrate not being a III-V compound][C0301]
- H01L33/00G3B2 [N: comprising nitride compounds] [N9412]
- H01L33/00G3C . . . [N: comprising nitride compounds] [N9412]
- H01L33/00G3D . . . [N: wafer bonding or at least partial removal of the growth substrate] [N0204]
- H01L33/00G4 . . [N: for devices with an active region comprising only II-VI compounds] [C0301]
- H01L33/00G4B . . . [N: with a substrate not being a II-VI compound] [C0301]
- H01L33/00G5 . . [N: for devices with an active region comprising only IV-VI compounds] [C0301]
- H01L33/00G6 . . [N: Post-treatments of the devices, e.g. annealing, recrystallisation, short-circuit elimination] [C1112]

- H01L33/02 . characterised by the semiconductor bodies [N0901]
- H01L33/02C . . [N: Physical imperfections, e.g. particular concentration or distribution of impurities] [N0901]
- H01L33/04 . . with a quantum effect structure or superlattice e.g. tunnel junction [N0901]
- H01L33/06 . . . within the light emitting region, e.g. quantum confinement structure or tunnel barrier [N0901]
- H01L33/08 . . with a plurality of light emitting regions, e.g. laterally discontinuous light emitting layer or photo-luminescent region integrated within the semiconductor body ([H01L27/15 takes precedence](#)) [N0901]
- H01L33/10 . . with a light reflecting structure, e.g. semiconductor Bragg reflector [N0901]
- H01L33/10C . . . [N: with a resonant cavity structure] [N0906]
- H01L33/12 . . with a stress relaxation structure, e.g. buffer layer [N0901]
- H01L33/14 . . with a carrier transport control structure, e.g. highly-doped semiconductor layer or current-blocking structure [N0901]
- H01L33/14C . . . [N: with a current-blocking structure] [N0901]
- H01L33/16 . . with a particular crystal structure or orientation, e.g. polycrystalline, amorphous or porous [N0901]
- H01L33/18 . . . within the light emitting region [N0901]

- Note** [N0901]
When classifying in this group, classification is also made in group [H01L33/26](#) or one of its subgroups in order to identify the chemical composition of the light emitting region
- H01L33/20 . . with a particular shape, e.g. curved or truncated substrate [N0901]
- H01L33/22 . . . Roughened surfaces, e.g. at the interface between epitaxial layers [N0901]
- H01L33/24 . . . of the light emitting region, e.g. non-planar junction [N0901]

- H01L33/26 . . Materials of the light emitting region [N0901]
- H01L33/28 . . . containing only elements of group II and group VI of the periodic system [N0901]
- H01L33/28C [N: characterised by the doping materials] [N0901]
- H01L33/30 . . . containing only elements of group III and group V of the periodic system [N0901]
- H01L33/30C [N: characterised by the doping materials] [N0901]
- H01L33/32 containing nitrogen [N0901]
- H01L33/32C [N: characterised by the doping materials] [N0901]
- H01L33/34 . . . containing only elements of group IV of the periodic system [N0901]
- H01L33/34C [N: characterised by the doping materials] [N0901]
- H01L33/34E [N: containing porous silicon] [N0901]

- H01L33/36 . characterised by the electrodes [N0901]
- H01L33/38 . . with a particular shape [N0901]
- H01L33/38B . . . [N: the electrode extending partially in or entirely through the semiconductor body] [N1203]
- H01L33/38C . . . [N: the electrode extending at least partially onto a side surface of the semiconductor body] [N1203]
- H01L33/38D . . . [N: with a plurality of electrode regions in direct contact with the semiconductor body and being electrically interconnected by another electrode layer] [N1203]
- H01L33/40 . . Materials therefor [N0901]
- H01L33/40C . . . [N: Reflective materials] [N0906]
- H01L33/42 . . . Transparent materials [N0901]

- H01L33/44 . characterised by the coatings, e.g. passivation layer or anti-reflective coating [N0901]
- H01L33/46 . . Reflective coating, e.g. dielectric Bragg reflector [N0901]
- H01L33/46C . . . [N: with a resonant cavity structure] [N0906]

- H01L33/48 . characterised by the semiconductor body packages [N0901] [C1112]

- Note** [N0901]
This group covers elements in intimate contact with the semiconductor body or integrated with the package
- H01L33/48C . . [N: Containers] [N0901]
- H01L33/48C2 . . . [N: adapted for surface mounting] [N0901]
- H01L33/50 . . Wavelength conversion elements [N0901] [C1112]
- H01L33/50B . . . [N: characterised by the materials, e.g. binder] [N1203]
- H01L33/50B2 [N: Wavelength conversion materials] [N1203]
- H01L33/50B2B [N: Elements with two or more wavelength conversion materials] [N1203]
- H01L33/50C . . . [N: characterised by the shape, e.g. plate or foil] [N1203]
- H01L33/50D . . . [N: the elements being in intimate contact with parts other than the semiconductor body or integrated with parts other than the semiconductor body] [N1203]
- H01L33/50E . . . [N: having a non-uniform spatial arrangement or non-uniform concentration, e.g. patterned wavelength conversion layer, wavelength conversion layer with a concentration gradient of the wavelength conversion material] [N1203]

- H01L33/52 . . Encapsulations [N0901]
- H01L33/54 . . . having a particular shape [N0901]
- H01L33/56 . . . Materials, e.g. epoxy or silicone resin [N0901] [C1112]
- H01L33/58 . . Optical field-shaping elements [N0901]
- H01L33/60 . . . Reflective elements [N0901]
- H01L33/62 . . Arrangements for conducting electric current to or from the semiconductor body, e.g. lead-frames, wire-bonds or solder balls [N0901]
- H01L33/64 . . Heat extraction or cooling elements [N0901]
- H01L33/64B . . . [N: characterized by the materials] [N1203]
- H01L33/64C . . . [N: characterized by the shape] [N1203]
- H01L33/64D . . . [N: in intimate contact or integrated with parts of the device other than the semiconductor body] [N1203]
- H01L33/64E . . . [N: the elements being electrically controlled, e.g. Peltier elements] [N1203]
- H01L33/64F . . . [N: the elements conducting electric current to or from the semiconductor body] [N1203]
- H01L33/64H . . . [N: the elements comprising fluids, e.g. heat-pipes] [N1203]

H01L35/00

Thermo-electric devices comprising a junction of dissimilar materials, i.e. exhibiting Seebeck or Peltier effect with or without other thermo-electric effects or thermomagnetic effects; Processes or apparatus peculiar to the manufacture or treatment thereof or of parts thereof; Details thereof (devices consisting of a plurality of solid state components formed in or on a common substrate [H01L27/00](#); refrigerating machines using electric or magnetic effects [F25B21/00](#); thermometers using thermoelectric or thermomagnetic elements [G01K7/00](#); obtaining energy from radioactive sources [G21H](#))

- H01L35/02 . Details
- H01L35/04 . . Structural details of the junction; Connection of leads
- H01L35/06 . . . detachable, e.g. using a spring
- H01L35/08 . . . non-detachable, e.g. cemented, sintered, soldered, [N: e.g. thin films]
- H01L35/10 . . . Connections of leads
- H01L35/12 . Selection of the material for the legs of the junction
- H01L35/14 . . using inorganic compositions
- H01L35/16 . . . comprising tellurium or selenium or sulfur
- H01L35/18 . . . comprising arsenic or antimony or bismuth ([H01L35/16](#) takes precedence), [N: e.g. AIII BV compounds]
- H01L35/20 . . . comprising metals only ([H01L35/16](#), [H01L35/18](#) take precedence)
- H01L35/22 . . . comprising compounds containing boron, carbon, oxygen or nitrogen [N: or germanium or silicon, e.g. superconductors]
- H01L35/22S [N: Superconducting materials]
- H01L35/24 . . using organic compositions
- H01L35/26 . . using compositions changing continuously or discontinuously inside the material
- H01L35/28 . operating with Peltier or Seebeck effect only
- H01L35/30 . . characterised by the heat-exchanging means at the junction
- H01L35/32 . . characterised by the structure or configuration of the cell or thermo-couple forming

- the device [N: including details about, e.g., housing, insulation, geometry, module]
- H01L35/32C . . . [N: Cascades of thermo-couples] [N9605]
- H01L35/34 . Processes or apparatus peculiar to the manufacture or treatment of these devices or of parts thereof (not peculiar thereto [H01L21/00](#))
- H01L37/00** **Thermoelectric devices without a junction of dissimilar materials; Thermomagnetic devices, e.g. using Nernst-Ettinghausen effect; Processes or apparatus peculiar to the manufacture or treatment thereof or of parts thereof** (devices consisting of a plurality of solid state components formed in or on a common substrate [H01L27/00](#); [N: radiation pyrometers using pyroelectric detectors [G01J5/34](#)] thermometers using thermo-electric or thermomagnetic elements [G01K7/00](#); selection of materials for magnetography, e.g. for Curie-point writing [G03G5/00](#))
- H01L37/02 . using thermal change of dielectric constant, e.g. working above and below Curie point [N: e.g. pyroelectric devices] [C1111]
- H01L37/02B . . [N: Selection of materials]
- H01L37/04 . using thermal change of magnetic permeability, e.g. working above and below the Curie point [N: e.g. pyromagnetic devices] [C1111]
- H01L39/00** **Devices using superconductivity; Processes or apparatus peculiar to the manufacture or treatment thereof or of parts thereof** (devices consisting of a plurality of solid state components formed in or on a common substrate [H01L27/00](#); [N: light detection [G01J](#), [G02F2/00](#); application to memories [G11C11/44](#), [G11C15/00](#), [G11C19/32](#)]; superconducting conductors cables or transmission lines [H01B12/00](#); [N: microwaves [H01P7/00](#), [H01P11/00](#)]; superconductive coils or windings [H01E](#); amplifiers using superconductivity [H03F19/00](#); [N: impulse generators and logic circuits [H03K3/38](#), [H03K17/92](#), [H03K19/195](#); lasers [H01S3/00](#), [H01S5/00](#)])
- [N: **Note**
In this group, in the absence of an indication to the contrary, an invention is classified in the last appropriate place
]
- H01L39/00A . [N: Alleged superconductivity] [N1111]
- H01L39/02 . Details
- H01L39/02B . . [N: for Josephson devices]
- H01L39/04 . . Containers; Mountings
- H01L39/04B . . . [N: for Josephson devices]
- H01L39/06 . . characterised by the current path
- H01L39/08 . . characterised by the shape of the element
- H01L39/10 . . characterised by the means for switching [N: between superconductive and normal states] [C1111]
- H01L39/12 . . characterised by the material
- H01L39/12B . . . [N: Organic materials]
- H01L39/12B2 [N: Fullerene superconductors, e.g. soccerball-shaped allotrope of carbon, e.g. C60, C94 (fullerenes in general [C07C13/00](#))]
- H01L39/12C . . . [N: Ceramic materials]

- H01L39/12C2 [N: comprising copper oxide]
- H01L39/12C2B [N: Multi-layered structures, e.g. super lattices]

- H01L39/14 . Permanent superconductor devices
- H01L39/14A . . [N: comprising metal borides, e.g. MgB2] [N0301]
- H01L39/14B . . [N: comprising high Tc ceramic materials]
- H01L39/14C . . [N: Three or more electrode devices ([H01L39/22D](#) takes precedence)] [C0301]
- H01L39/14C2 . . . [N: Field effect devices]
- H01L39/14V . . [N: Abrikosov vortex devices]

- H01L39/16 . Devices switchable between superconductive and normal states, [N: e.g. switches, current limiters (circuits for current limitation using superconductor elements [H02H9/02C](#))] [C0301]

- H01L39/18 . . Cryotrons
- H01L39/20 . . . Power cryotrons [C0301]

- H01L39/22 . Devices comprising a junction of dissimilar materials, e.g. Josephson-effect devices
- H01L39/22B . . [N: Single electron tunnelling devices]
- H01L39/22C . . [N: Josephson-effect devices]
- H01L39/22C2 . . . [N: comprising high Tc ceramic materials]
- H01L39/22C4 . . . [N: comprising metal borides, e.g. MgB2] [N0301]
- H01L39/22D . . [N: three or more electrode devices, e.g. transistor-like structures]

- H01L39/24 . Processes or apparatus peculiar to the manufacture or treatment of devices provided for in [H01L39/00](#) or of parts thereof
- H01L39/24B . . [N: Processes peculiar to the manufacture or treatment of composite superconductor filaments (comprising copper oxide [H01L39/24J](#))]
- H01L39/24E . . [N: of devices comprising Nb or an alloy of Nb with one or more of the elements of group 4, e.g. Ti, Zr, Hf]
- H01L39/24F . . [N: of devices comprising an intermetallic compound of type A-15, e.g. Nb3Sn]
- H01L39/24G . . [N: of devices comprising molybdenum chalcogenides]
- H01L39/24H . . [N: of devices comprising nitrides or carbonitrides]
- H01L39/24J . . [N: the superconducting material comprising copper oxide]
- H01L39/24J2 . . . [N: Processes for depositing or forming superconductor layers]
- H01L39/24J2B [N: from a solution]
- H01L39/24J2C [N: from a suspension or slurry, e.g. screen printing; doctor blade casting]
- H01L39/24J2D [N: by evaporation independent of heat source, e.g. MBE]
- H01L39/24J2E [N: by sputtering]
- H01L39/24J2F [N: by chemical vapour deposition (CVD)]
- H01L39/24J2F2 [N: by metalloorganic chemical vapour deposition (MOCVD)]
- H01L39/24J2G [N: by thermal spraying, e.g. plasma deposition]
- H01L39/24J2H [N: Pulsed laser deposition, e.g. laser sputtering; laser ablation]
- H01L39/24J2J [N: Precursor deposition followed by after#-treatment, e.g. oxidation] [M1205]
- H01L39/24J2P [N: characterised by the substrate]

- H01L39/24J2P2 [N: Monocrystalline substrates, e.g. epitaxial growth]
- H01L39/24J2P4 [N: Intermediate layers, e.g. for growth control] [C1111]
- H01L39/24J4 [N: After-treatment, e.g. patterning] [M1205]
- H01L39/24J4B [N: Etching]
- H01L39/24J4C [N: Passivation]
- H01L39/24J6 [N: Manufacture or deposition of contacts or electrodes]
- H01L39/24J8 [N: Processes including the use of precursors]
- H01L39/24J10 [N: Processes peculiar to the manufacture or treatment of filaments or composite wires]
- H01L39/24J12 [N: Introducing flux pinning centres]
- H01L39/24K [N: of devices comprising metal borides, e.g. MgB₂] [N0301]
- H01L39/24M [N: Treatment of superconductive layers by irradiation, e.g. ion-beam, electron-beam, laser beam, X-rays (**irradiation devices** [G21K](#), [H01J](#))]
- H01L39/24N [N: for Josephson devices]
- H01L39/24N2 [N: comprising high T_c ceramic materials]

H01L41/00

Piezo-electric devices in general; Electrostrictive devices in general; Magnetostrictive devices in general; Processes or apparatus specially adapted for the manufacture or treatment thereof or of parts thereof; Details thereof (devices consisting of a plurality of solid-state components formed in or on a common substrate H01L 27/00) [C1202]

[N: WARNING

[N1202] 1. Groups H01L 41/22 - 41/47 correspond to IPC2013.01. Concordance ECLA : IPC for these groups is as follows: - H01L 41/22 - 41/37 : H01L 41/22 - H01L 41/39 - 41/43 : H01L 41/24 - H01L 41/45 : H01L 41/26 - H01L 41/47 : H01L 41/22 2. Pending reorganisation, the groups [H01L41/23](#) to [H01L41/47](#) are not complete; see provisionally also [H01L41/22](#)
]

- H01L41/02 . Details
- H01L41/04 . . of piezo-electric or electrostrictive devices
- H01L41/04B [N: Drive or control circuitry or methods for piezo-electric or electrostrictive devices not otherwise provided for] [C1111]
- H01L41/04B4 [N: for piezoelectric transformers (conversion of DC or AC power H02M; for operating discharge lamps H05B41/282)] [N0301]
- H01L41/047 Electrodes [N: or electrical connection arrangements] [N9611]
- [N: **WARNING** [N1111]
Pending reorganisation, the groups [H01L41/047B](#) to [H01L41/047M](#) are not complete, see provisionally also [H01L41/047](#)
]
- H01L41/047B [N: Individual layer electrodes of multilayer piezo-electric or electrostrictive devices, e.g. internal electrodes] [N1111]
- H01L41/047D [N: Connection electrodes of multilayer piezo-electric or electrostrictive devices, e.g. external electrodes] [N1111]
- H01L41/047D2 [N: embedded within piezo-electric or electrostrictive material, e.g. via connections] [N1204]
- H01L41/047F [N: Further connection or lead arrangements, e.g. flexible wiring boards, terminal pins] [N1111]

- H01L41/047M [N: Conductive materials (in general [H01B1/00](#))] [N1111]
- H01L41/047M2 [N: the principal material being non-metallic, e.g. oxide or carbon based] [N1204]
- H01L41/053 Mounts, supports, enclosures or casings [N9611]
- [N: **WARNING** [N1111]
Pending reorganisation, the groups [H01L41/053C](#) to [H01L41/053P](#) are not complete, see provisionally also [H01L41/053](#)]
- H01L41/053C [N: Further insulation means against electrical, physical or chemical damage, e.g. protective coatings] [N1111]
- H01L41/053P [N: Mechanical prestressing means, e.g. springs (in general [F16F1/00](#))] [N1111]
- H01L41/06 . . . of magnetostrictive devices
- H01L41/08 . . Piezo-electric or electrostrictive devices
- [N: **WARNING** [N1111]
Pending reorganisation, the groups [H01L41/08C](#), [H01L41/08F](#), and [H01L41/08S](#) are not complete, see provisionally also [H01L41/08](#)]
- H01L41/08C . . . [N: based on piezo-electric or electrostrictive films or coatings] [N1111]
- H01L41/08C2 [N: characterised by the underlying base, e.g. substrates] [N1111]
- H01L41/08C2B [N: Intermediate layers, e.g. barrier, adhesion or growth control buffer layers] [N1111]
- H01L41/08F . . . [N: based on piezo-electric or electrostrictive fibres] [N1111]
- H01L41/08S . . . [N: with electrical and mechanical input and output, e.g. having combined actuator and sensor parts] [N1111]
- H01L41/083 . . . having a stacked or multilayer structure [N9611] [M1202]
- [N: **WARNING**[N1111]
Pending reorganisation, the groups [H01L41/083B](#) to [H01L41/083S](#) are not complete, see provisionally also [H01L41/083](#)]
- H01L41/083B [N: with non-rectangular cross-section in stacking direction, e.g. polygonal, trapezoidal] [N1111]
- H01L41/083D [N: with non-rectangular cross-section orthogonal to the stacking direction, e.g. polygonal, circular] [N1111]
- H01L41/083D2 [N: Annular cross-section] [N1111]
- H01L41/083F [N: of cylindrical shape with stacking in radial direction, e.g. coaxial or spiral type rolls] [N1202]
- H01L41/083S [N: adapted for alleviating internal stress, e.g. cracking control layers ("Sollbruchstellen")] [N1202]
- H01L41/087 . . . formed as coaxial cables [N9611]
- H01L41/09 . . . with electrical input and mechanical output [N: e.g. actuators, vibrators (in frequency selective networks H03H9)] [C1111]
- H01L41/09B [N: using longitudinal or thickness displacement combined with bending, shear or torsion displacement]
- [N: **WARNING** [N1111]

- Pending reorganisation, the groups [H01L41/09B2](#) to [H01L41/09B4](#) are not complete, see provisionally also [H01L41/09B](#)
]
- H01L41/09B2 [N: with polygonal or rectangular shape] [N1111]
H01L41/09B4 [N: with cylindrical or annular shape] [N1111]
H01L41/09G . . . [N: using bending displacement, e.g. unimorph, bimorph or multimorph cantilever or membrane benders] [M1205]
- [N: **WARNING** [N1111]
Pending reorganisation, the groups [H01L41/09G2](#) to [H01L41/09G4B](#) are not complete, see provisionally also [H01L41/09G](#)
]
- H01L41/09G2 [N: Beam type] [N1111]
H01L41/09G2B [N: Cantilevers, i.e. having one fixed end] [N1111]
H01L41/09G2B2 [N: connected at their free ends, e.g. parallelogram type] [N1111]
H01L41/09G2B4 [N: with multiple segments mechanically connected in series, e.g. zig-zag type] [N1111]
H01L41/09G2B6 [N: adapted for in-plane bending displacement] [N1111]
H01L41/09G2B8 [N: adapted for multi-directional bending displacement] [N1111]
H01L41/09G4 [N: Membrane type] [N1111]
H01L41/09G4B N: with non-planar shape] [N1111]
H01L41/09L . . . [N: using longitudinal or thickness displacement only, e.g. d33 or d31 type devices] [N1111]
- [N: **WARNING**[N1111]
Pending reorganisation, this group is not complete, see provisionally also [H01L41/09](#)
]
- H01L41/09S . . . [N: using shear or torsion displacement, e.g. d15 type devices] [N1111]
- [N: **WARNING** [N1111]
Pending reorganisation, this group is not complete, see provisionally also [H01L41/09](#)
]
- H01L41/107 . . with electrical input and electrical output [N: e.g. transformers] [C1111]
H01L41/113 . . with mechanical input and electrical output [N: e.g. generators, sensors] [C1111]
- [N: **WARNING** [N1111]
Pending reorganisation, the groups [H01L41/113](#) to [H01L41/113M](#) are not complete, see provisionally also [H01L41/113](#) and [H02N2/18](#)
]
- H01L41/113C . . . [N: Sensors]
H01L41/113G . . . [N: Beam type] [N1111]
H01L41/113G2 [N: Cantilevers] [N1111]
H01L41/113M . . . [N: Membrane type] [N1111]
- H01L41/12 . . Magnetostrictive devices
H01L41/12B . . [N: with mechanical input and electrical output, e.g. generators, sensors] [N9803] [C1111]

- H01L41/16 . Selection of materials
- H01L41/18 . . for piezo-electric or electrostrictive devices [N: e.g. bulk piezo-electric crystals] [C1111]
- H01L41/18C . . . [N: Composite materials, e.g. having 1-3 or 2-2 type connectivity] [N1111]
- [N: **WARNING** [N1111]
Pending reorganisation, this group is not complete, see provisionally also [H01L41/18](#)]
- H01L41/187 . . . Ceramic compositions [N: i.e. synthetic inorganic polycrystalline compounds incl. epitaxial, quasi-crystalline materials] [C1111]
- [N: **WARNING**
Pending reorganisation, the groups [H01L41/187B](#) to [H01L41/187R](#) are not complete, see provisionally also [H01L41/187](#)]
- H01L41/187B [N: Alkaline earth metal based oxides, e.g. barium titanates] [N1111]
- H01L41/187L [N: Alkali metal based oxides, e.g. lithium, sodium or potassium niobates] [N1111]
- H01L41/187P [N: Lead based oxides] [N1111]
- H01L41/187P2 [N: Lead zirconate titanate based] [N1111]
- H01L41/187R [N: Bismuth based oxides] [N1111]
- H01L41/193 . . . Macromolecular compositions [N: e.g. piezo-electric polymers] [C1111]
- H01L41/20 . . for magnetostrictive devices
- H01L41/22 . Processes or apparatus specially adapted for the assembly, manufacture or treatment of piezo-electric or electrostrictive devices or of parts thereof [C1202]
- H01L41/23 . . Forming enclosures or casings [N1202]
- H01L41/25 . . Assembling devices that include piezo-electric or electrostrictive parts [N1202]
- H01L41/253 . . Treating devices or parts thereof to modify a piezo-electric or electrostrictive property, e.g. polarisation characteristics, vibration characteristics or mode tuning [N1202]
- . . . by polarising [N1202]
- H01L41/27 . . Manufacturing multilayered piezo-electric or electrostrictive devices or parts thereof, e.g. by stacking piezo-electric bodies and electrodes [N1202]
- H01L41/273 . . . by integrally sintering piezo-electric or electrostrictive bodies and electrodes [N1202]
- H01L41/277 . . . by stacking bulk piezo-electric or electrostrictive bodies and electrodes [N1202]
- H01L41/29 . . Forming electrodes, leads or terminal arrangements [N1202]
- H01L41/293 . . . Connection electrodes of multilayered piezo-electric or electrostrictive parts [N1202]
- [N: **Notes**
[N1202]Integral individual layer electrode and connection electrode are classified in both [H01L41/293](#) and [H01L41/297](#)]
- H01L41/297 . . . Individual layer electrodes of multilayered piezo-electric or electrostrictive parts [N1202]
- [N: **Notes**

[N1202]Integral individual layer electrode and connection electrode are classified in both [H01L41/293](#) and [H01L41/297](#)
]

- H01L41/31 . . Applying piezo-electric or electrostrictive parts or bodies onto an electrical element or another base [N1202]
- H01L41/311 . . . Mounting of piezo-electric or electrostrictive parts together with semiconductor elements, or other circuit elements, on a common substrate [N1202]
- H01L41/312 . . . by laminating or bonding of piezo-electric or electrostrictive bodies [N1202]
- H01L41/313 by metal fusing or with adhesives [N1202]
- H01L41/314 by depositing piezo-electric or electrostrictive layers, e.g. aerosol or screen printing [N1202]
- H01L41/316 by vapour phase deposition [N1202]
- H01L41/317 by liquid phase deposition [N1202]
- H01L41/318 by sol-gel deposition [N1202]
- H01L41/319 using intermediate layers, e.g. for growth control [N1202]
- H01L41/33 . . Shaping or machining of piezo-electric or electrostrictive bodies [N1202]
- H01L41/331 . . . by coating or depositing using masks, e.g. lift-off [N1202]
- H01L41/332 . . . by etching, e.g. lithography [N1202]
- H01L41/333 . . . by moulding or extrusion [N1202]
- H01L41/335 . . . by machining [N1202]
- H01L41/337 by polishing or grinding [N1202]
- H01L41/338 by cutting or dicing [N1202]
- H01L41/339 by punching [N1202]
- H01L41/35 . . Forming piezo-electric or electrostrictive materials [N1202]
- H01L41/37 . . . Composite materials [N1202]
- H01L41/39 . . . Inorganic materials [N1202]
- H01L41/41 by melting [N1202]
- H01L41/43 by sintering [N1202]
- H01L41/45 . . . Organic materials [N1202]

- H01L41/47 . Processes or apparatus specially adapted for the assembly, manufacture or treatment of magnetostrictive devices or of parts thereof [N1202]

H01L43/00 **Devices using galvano-magnetic or similar magnetic effects; Processes or apparatus peculiar to the manufacture or treatment thereof or of parts thereof** (devices consisting of a plurality of solid state components formed in or on a common substrate [H01L27/00](#); devices with potential-jump barrier, or surface barrier controllable by variation of a magnetic field [H01L29/82](#))

- H01L43/02 . Details
- H01L43/04 . . of Hall-effect devices

- H01L43/06 . Hall-effect devices
- H01L43/06B . . [N: Semiconductor Hall-effect devices]

- H01L43/08 . Magnetic-field-controlled resistors

- H01L43/10 . Selection of materials
- H01L43/12 . Processes or apparatus peculiar to the manufacture or treatment of these devices or of parts thereof ([not peculiar thereto H01L21/00](#))
- H01L43/14 . . for Hall-effect devices

- H01L45/00** **Solid state devices adapted for rectifying, amplifying, oscillating or switching without a potential-jump barrier or surface barrier, e.g. dielectric triodes; Ovshinsky-effect devices; Processes or apparatus peculiar to the manufacture or treatment thereof or of parts thereof** ([devices consisting of a plurality of solid state components formed in or on a common substrate H01L27/00](#); [devices using superconductivity H01L39/00](#); [piezo-electric devices H01L41/00](#); [bulk negative resistance effect devices H01L47/00](#); [N: memories [G11C11/34](#); [G11C13/00R](#); [amplifying circuits H03F11/00](#); [pulse generation H03K3/02](#); [electronic switching circuits H03K17/00](#); [logic circuits H03K19/00](#)]) [C1203]

[N: **WARNING**
 [N1203]Groups [H01L45/04](#) - [H01L45/16](#) do not correspond to former or current IPC groups. IPC concordance of said groups is - [H01L45/04](#) - [H01L45/16](#) : [H01L45/00](#). Groups [H01L45/06](#) to [H01L45/16P6](#) are not complete pending reclassification; see provisionally also group [H01L45/04](#)
]
- H01L45/00C . [N: Charge density wave transport devices]
- H01L45/02 . Solid state travelling-wave devices
- H01L45/04 . [N: Bistable or multistable switching devices, e.g. for resistance switching non-volatile memory] [N1203]
- H01L45/06 . . [N: based on solid-state phase change, e.g. between amorphous and crystalline phases, Ovshinsky effect] [N1203]
- H01L45/06C . . . [N: between different crystalline phases, e.g. cubic and hexagonal] [N1203]
- H01L45/08 . . [N: based on migration or redistribution of ionic species, e.g. anions, vacancies] [N1203]
- H01L45/08M . . . [N: the species being metal cations, e.g. programmable metallization cells] [N1203]
- H01L45/10 . . [N: based on bulk electronic defects, e.g. trapping of electrons] [N1203]
- H01L45/12 . . [N: Details] [N1203]
- H01L45/12B . . . [N: Three or more terminal devices, e.g. transistor like devices] [N1203]
- H01L45/12C . . . [N: Radiation or particle beam assisted switching devices, e.g. optically controlled devices] [N1203]
- H01L45/12D . . . [N: Device geometry] [N1203]
- H01L45/12D2 [N: adapted for essentially horizontal current flow, e.g. bridge type devices] [N1203]
- H01L45/12D4 [N: adapted for essentially vertical current flow, e.g. sandwich or pillar type devices] [N1203]
- H01L45/12D4B [N: on sidewalls of dielectric structures, e.g. mesa or cup type devices] [N1203]
- H01L45/12D6 [N: Further means within the switching material region to limit current flow, e.g. constrictions] [N1203]

- H01L45/12E . . . [N: Electrodes] [N1203]
- H01L45/12E2 [N: adapted for resistive heating] [N1203]
- H01L45/12E4 [N: adapted for supplying ionic species] [N1203]
- H01L45/12E6 [N: adapted for electric field or current focusing, e.g. tip shaped] [N1203]
- H01L45/12T . . . [N: Thermal details] [N1203]
- H01L45/12T2 [N: Heating or cooling means other than resistive heating electrodes, e.g. heater in parallel] [N1203]
- H01L45/12T4 [N: Thermal insulation means] [N1203]
- H01L45/14 . . [N: Selection of switching materials] [N1203]
- H01L45/14B . . . [N: Compounds of sulfur, selenium or tellurium, e.g. chalcogenides] [N1203]
- H01L45/14B2 [N: Sulfides, e.g. CuS] [N1203]
- H01L45/14B4 [N: Selenides, e.g. GeSe] [N1203]
- H01L45/14B6 [N: Tellurides, e.g. GeSbTe] [N1203]
- H01L45/14C . . . [N: Oxides or nitrides] [N1203]
- H01L45/14C2 [N: Binary metal oxides, e.g. TaOx] [N1203]
- H01L45/14C4 [N: Complex metal oxides, e.g. perovskites, spinels] [N1203]
- H01L45/14D . . . [N: Other compounds of groups 13-15, e.g. elemental or compound semiconductors] [N1203]
- H01L45/14D2 [N: Carbon or carbides] [N1203]
- H01L45/16 . . [N: Manufacturing] [N1203]
- H01L45/16D . . . [N: Formation of the switching material, e.g. layer deposition] [N1203]
- H01L45/16D2 [N: by chemical vapor deposition, e.g. MOCVD, ALD] [N1203]
- H01L45/16D4 [N: by physical vapor deposition, e.g. sputtering] [N1203]
- H01L45/16D6 [N: by conversion of electrode material, e.g. oxidation] [N1203]
- H01L45/16M . . . [N: Modification of the switching material, e.g. post-treatment, doping] [N1203]
- H01L45/16M2 [N: by implantation] [N1203]
- H01L45/16M4 [N: by diffusion, e.g. photo-dissolution] [N1203]
- H01L45/16P . . . [N: Patterning of the switching material] [N1203]
- H01L45/16P2 [N: by etching of pre-deposited switching material layers, e.g. lithography] [N1203]
- H01L45/16P4 [N: by filling of openings, e.g. damascene method] [N1203]
- H01L45/16P6 [N: Patterning process specially adapted for achieving sub-lithographic dimensions, e.g. using spacers] [N1203]

H01L47/00

Bulk negative resistance effect devices, e.g. Gunn-effect devices; Processes or apparatus peculiar to the manufacture or treatment thereof or of parts thereof (devices consisting of a plurality of solid state components formed in or on a common substrate [H01L27/00](#))

- H01L47/00B . [N: Processes or apparatus peculiar to the manufacture or treatment of these devices or of parts thereof (not peculiar thereto [H01L21/00](#))]
- H01L47/02 . Gunn-effect devices [N: or transferred electron devices]
- H01L47/02B . . [N: controlled by electromagnetic radiation]
- H01L47/02C . . [N: Gunn diodes ([H01L47/02](#) takes precedence)]

- H01L49/00** **Solid state devices not provided for in groups [H01L27/00](#) to [H01L47/00](#) and [H01L51/00](#) and not provided for in any other subclass; Processes or apparatus peculiar to the manufacture or treatment thereof or of parts thereof [C9907]**
- [H01L49/00A](#) . [N: Devices using Mott metal-insulator transition, e.g. field effect transistors] [N0110]
- [H01L49/00Q](#) . [N: Quantum devices, e.g. Quantum Interference Devices, Metal Single Electron Transistor (using semiconductors in the active part [H01L29/00](#))] [N0110]
- [H01L49/02](#) . Thin-film or thick-film devices
- H01L51/00** **Solid state devices using organic materials as the active part, or using a combination of organic materials with other materials as the active part; Processes or apparatus specially adapted for the manufacture or treatment of such devices, or of parts thereof (devices consisting of a plurality of components formed in or on a common substrate [H01L27/28](#); thermoelectric devices using organic material [H01L35/00](#), [H01L37/00](#); piezoelectric, electrostrictive or magnetostrictive elements using organic material [H01L41/00](#)) [C0308]**
- [H01L51/00A](#) . [N: Processes specially adapted for the manufacture or treatment of devices or of parts thereof (multistep processes [H01L51/00T](#), [H01L51/05](#), [H01L51/12](#), [H01L51/50](#))] [N0605]
- [H01L51/00A2](#) . . [N: Deposition of organic semiconductor materials on a substrate] [N0605]
- [H01L51/00A2B](#) . . . [N: using liquid deposition, e.g. spin coating] [N0605]
- [H01L51/00A2B2](#) [N: using printing techniques, e.g. ink-jet printing, screen printing] [N0605]
- [H01L51/00A2B2B](#) [N: ink-jet printing] [N0607]
- [H01L51/00A2B4](#) [N: Electrolytic deposition using an external electrical current, e.g. in-situ electropolymerisation] [N0605]
- [H01L51/00A2B6](#) [N: characterised by the solvent] [N0605]
- [H01L51/00A2D](#) [N: using physical deposition, e.g. sublimation, sputtering] [N0605]
- [H01L51/00A2D2](#) [N: using laser ablation] [N0605]
- [H01L51/00A2D4](#) [N: Vacuum deposition] [N0605]
- [H01L51/00A2D6](#) [N: selective deposition, e.g. using a mask] [N0605]
- [H01L51/00A2F](#) [N: special provisions for the orientation or alignment of the layer to be deposited] [N0605]
- [H01L51/00A2H](#) [N: using non liquid printing techniques, e.g. thermal transfer printing from a donor sheet] [N0605]
- [H01L51/00A4](#) . . . [N: for changing the shape of the device layer, e.g. patterning] [N0605]
- [H01L51/00A4B](#) [N: by selective transformation of an existing layer] [N0605]
- [H01L51/00A4D](#) [N: lift off techniques] [N0605]
- [H01L51/00A4F](#) [N: etching of an existing layer] [N0605]
- [H01L51/00A4F2](#) [N: using photolithographic techniques] [N0605]
- [H01L51/00A4F4](#) [N: using printing techniques, e.g. applying the etch liquid using an ink jet printer] [N0605]
- [H01L51/00A6](#) . . . [N: Making n- or p-doped regions] [N0605]
- [H01L51/00A8](#) . . . [N: Formation of conductors] [N0605]
- [H01L51/00A8B](#) [N:using printing techniques, e.g. ink jet printing] [N0605]

- H01L51/00A8D . . . [N: Patterning of conductive layers] [N0906]
- H01L51/00A10 . . [N: for forming devices by joining two substrates together, e.g. lamination technique] [N0605]
- H01L51/00A12 . . [N: Purification process of the organic semiconductor material] [N0605]
- H01L51/00A16 . . [N: Thermal treatment of the active layer, e.g. annealing] [N0906]
- H01L51/00A16L . . . [N: using coherent electromagnetic radiation, e.g. laser annealing] [N0906]
- H01L51/00A16S . . . [N: Thermal treatment in the presence of solvent vapors, e.g. solvent annealing] [N0906]
- H01L51/00A22 . . [N: Special provisions for controlling the atmosphere during processing ([H01L51/00A16](#) takes precedence)] [N0906]
- H01L51/00A24 . . [N: using a temporary substrate] [N0906]
- H01L51/00A26 . . [N: Testing, e.g. accelerated lifetime tests of photoelectric devices] [N0906]
- H01L51/00M . . [N: Selection of organic semiconducting materials, e.g. organic light sensitive or organic light emitting materials] [N0605]

[N: Notes]

This group only covers the selection of organic materials for their electrical or other properties insofar as they are specific for their use in devices covered by the group [H01L51/00](#).

For the materials per se, see the relevant subclasses.

Attention is drawn to the following places:

- organic materials in general [C07C](#), [C07D](#), [C07F](#), [C08L](#);

- organic materials as electrical conductors [H01B1/12](#);

- organic materials as electrical insulators [H01B3/18](#)

]

- H01L51/00M2 . . [N: Organic polymers or oligomers (organic macromolecular compounds or compositions per se [C08](#))] [N0605]
- H01L51/00M2B . . . [N: comprising aromatic, heteroaromatic, or aryl chains, e.g. polyaniline (per se [C08G73/02N](#)), polyphenylene (per se [C08G61/10](#)), polyphenylene vinylene (per se [C08G61/02](#))] [N0605]
- H01L51/00M2B2 [N: Heteroaromatic compounds comprising sulfur or seleno, e.g. polythiophene (per se [C08G61/12D1F](#))] [N0605]
- H01L51/00M2B2B [N: Polyethylene dioxythiophene (PEDOT) and derivatives] [N0605]
- H01L51/00M2B4 [N: Poly-phenylenevinylene and derivatives (per se [C08G61/10](#))] [N0605]
- H01L51/00M2B6 [N: Polyfluorene and derivatives] [N0605]
- H01L51/00M2D . . . [N: comprising aliphatic or olefinic chains, e.g. poly N-vinylcarbazol, PVC, PTFE] [N0605]
- H01L51/00M2D2 [N: Poly acetylene (per se [C08G61/04](#), [C08F38/02](#), [C08F138/02](#), [C08F238/02](#)) or derivatives] [N0605] [C1108]
- H01L51/00M2D4 [N: poly N-vinylcarbazol and derivatives] [N0605]
- H01L51/00M2F . . . [N: Copolymers] [N0605]
- H01L51/00M2H . . . [N: Ladder-type polymers] [N0605]
- H01L51/00M4 . . [N: Carbon containing materials, e.g. carbon nanotubes, fullerenes (per se [C01B31/02B](#))] [N0605]
- H01L51/00M4B . . . [N: Fullerenes, e.g. C60, C70] [N0605] [C0703]
- H01L51/00M4B2 [N: comprising substituents, e.g. PCBM] [N0703]
- H01L51/00M4D . . . [N: Carbon nanotubes] [N0605]
- H01L51/00M4D2 [N: comprising substituents] [N0703]

- H01L51/00M6 . . . [N: Macromolecular systems with low molecular weight, e.g. cyanine dyes, coumarine dyes, tetrathiafulvalene ([H01L51/00M4](#), [H01L51/00M12](#), [H01L51/00M14](#), [H01L51/30M16](#) take precedence)] [N0605]
- H01L51/00M6B . . . [N: Charge transfer complexes] [N0605]
- H01L51/00M6D . . . [N: Polycyclic condensed aromatic hydrocarbons, e.g. anthracene] [N0605] [C0703]
- H01L51/00M6D2 [N: Aromatic anhydride or imide compounds, e.g. perylene tetra-carboxylic dianhydride, perylene tetracarboxylic diimide] [N0605]
- H01L51/00M6D4 [N: containing four rings, e.g. pyrene] [N0703]
- H01L51/00M6D6 [N: containing five rings, e.g. pentacene] [N0703]
- H01L51/00M6D8 [N: containing six or more rings] [N0703]
- H01L51/00M6D10 [N: containing at least one aromatic ring having 7 or more carbon atoms, e.g. azulene] [N0703]
- H01L51/00M6D12 [N: containing more than one polycyclic condensed aromatic rings, e.g. bis-anthracene] [N0703]
- H01L51/00M6F [N: Amine compounds having at least two aryl rest on at least one amine-nitrogen atom, e.g. triphenylamine (per se C07C211/00)] [N0605]
- H01L51/00M6F2 [N: comprising polycyclic condensed aromatic hydrocarbons as substituents on the nitrogen atom] [N0703]
- H01L51/00M6F4 [N: comprising heteroaromatic hydrocarbons as substituents on the nitrogen atom] [N0703]
- H01L51/00M6H [N: aromatic compounds comprising a hetero atom, e.g.: N,P,S] [N0605]
- H01L51/00M6H4 [N: Cyanine Dyes] [N0605]
- H01L51/00M6H6 [N: comprising only oxygen as heteroatom] [N0703]
- H01L51/00M6H8 [N: comprising only nitrogen as heteroatom (H01L51/00M6H4 takes precedence)] [N0703]
- H01L51/00M6H10 [N: comprising only sulfur as heteroatom] [N0703]
- H01L51/00M6H12 [N: comprising two or more different heteroatoms per ring, e.g. S and N (H01L51/00M6H4 takes precedence)] [N0612]
- H01L51/00M6H12B [N: oxadiazole compounds] [N0612]
- H01L51/00M6H14 [N: Polycyclic condensed heteroaromatic hydrocarbons] [N0703]
- H01L51/00M6H14B [N: comprising only nitrogen in the heteroaromatic polycondensed ringsystem, e.g. phenanthroline, carbazole] [N0906]
- H01L51/00M6H14D [N: comprising only oxygen in the heteroaromatic polycondensed ringsystem, e.g. coumarine dyes] [N0906]
- H01L51/00M6H14F [N: comprising only sulfur in the heteroaromatic polycondensed ringsystem, e.g. benzothiophene] [N0906]
- H01L51/00M8 . . . [N: Langmuir Blodgett films (per se B05D1/20C)] [N0605]
- H01L51/00M10 . . . [N: Liquid crystalline materials (per se [C09K19/00](#))] [N0605]
- H01L51/00M12 . . . [N: Coordination compounds, e.g. porphyrin] [N0605] [C0703]
- H01L51/00M12B . . . [N: Phthalocyanine (per se C09B47/04)] [N0605]
- H01L51/00M12D . . . [N: Metal complexes comprising a IIIB-metal (B, Al, Ga, In or Tl), e.g. Tris (8-hydroxyquinoline) gallium (Gaq3)] [N0605] [C0703]
- H01L51/00M12D2 [N: comprising boron] [N0703]
- H01L51/00M12D4 [N: comprising aluminium, e.g. Alq3] [N0703]
- H01L51/00M12D6 [N: comprising gallium] [N0906]
- H01L51/00M12E . . . [N: Metal complexes comprising an iron-series metal, e.g. Fe, Co, Ni] [N0703]

- H01L51/00M12F . . . [N: Transition metal complexes, e.g. Ru(II)polypyridine complexes] [N0605]
- H01L51/00M12F2 [N: comprising Iridium] [N0605]
- H01L51/00M12F4 [N: comprising Ruthenium] [N0605]
- H01L51/00M12F6 [N: comprising platinum] [N0703]
- H01L51/00M12F8 [N: comprising osmium] [N0703]
- H01L51/00M12H . . . [N: Metal complexes comprising Lanthanides or Actinides, e.g. Eu] [N0605]
- H01L51/00M12K . . . [N: Polynuclear complexes, i.e. complexes having two or more metal centers] [N0703]
- H01L51/00M12M . . . [N: Metal complexes comprising a IB-metal (Cu, Ag, Au)] [N0906]
- H01L51/00M12N . . . [N: Metal complexes comprising a IIB-metal (Zn, Cd, Hg)] [N0906]
- H01L51/00M14 . . [N: Biomolecules or bio-macromolecules, e.g. proteines, ATP, chlorophyl, beta-carotene, lipids, enzymes] [N0605]
- H01L51/00M16 . . [N: Silicon-containing organic semiconductors] [N0605]
- H01L51/00M18 . . [N: Starburst compounds] [N0703]

- H01L51/00S . [N: Substrates] [N0507]
- H01L51/00S2 . . [N: flexible substrates] [N0507]

- H01L51/00T . [N: Molecular electronic devices (molecular computers G06F15/80; molecular memories G11C11/00, G11C13/02)] [N0605]

- H01L51/05 . specially adapted for rectifying, amplifying, oscillating or switching, or capacitors or resistors with at least one potential- jump barrier or surface barrier [N: multistep processes for their manufacture] [N0605]

- H01L51/05B . . [N: the devices being controllable only by the electric current supplied or the electric potential applied, to an electrode which does not carry the current to be rectified, amplified or swiched, e.g. three-terminal devices] [N0605]

- H01L51/05B2 . . . [N: Field-effect devices, e.g. TFTs] [N0605]
- H01L51/05B2B [N: insulated gate field effect transistors] [N0605]
- H01L51/05B2B2 [N:characterised by the gate dielectric] [N0605] [C0607]
- H01L51/05B2B2B [N: the gate dielectric comprising only organic materials] [N0607]
- H01L51/05B2B2D [N: the gate dielectric comprising only inorganic materials] [N0607]
- H01L51/05B2B2F [N: the gate dielectric having a multilayered structure] [N0607]
- H01L51/05B2B2F2 {7 dots} [N: Combinations of organic and inorganic layers] [N1108]
- H01L51/05B2B2H [N: the gate dielectric comprising composite materials, e.g. TiO2 particles in a polymer matrix] [N0607]

- H01L51/05B2B4 [N: Lateral single gate single channel transistors with non inverted structure, i.e. the organic semiconductor layer is formed before the gate electrode] [N0605] [C0608]

- H01L51/05B2B6 [N: Lateral single gate single channel transistors with inverted structure, i.e. the organic semiconductor layer is formed after the gate electrode] [N0605]

- H01L51/05B2B8 [N: characterised by the gate conductor] [N0605]
- H01L51/05B2B8B [N: the transistor having two or more gate electrodes] [N0906]
- H01L51/05B2B10 [N: characterised by the channel of the transistor] [N0906]
- H01L51/05B2B10B [N: the channel comprising two or more active layers, e.g. forming pn - hetero junction] [N0906]

- H01L51/05B2B10D [N: the channel comprising a composite layer, e.g. a mixture of donor and acceptor moieties, forming pn - bulk hetero junction] [N0906]
- H01L51/05B2B12 [N: having a vertical structure, e.g. vertical carbon nanotube field effect transistors [CNT-FETs]] [N1108]
- H01L51/05D . . . [N: the devices being controllable only by variation of the electric current supplied or the electric potential applied, to one or more of the electrodes carrying the current to be rectified, amplified, oscillated or switched, e.g. two-terminal devices] [N0605]
- H01L51/05D2 . . . [N: Schottky diodes] [N0605]
- H01L51/05D4 . . . [N: comprising an organic/organic junction, e.g. hetero-junction] [N0605]
- H01L51/05D6 . . . [N: comprising an organic/inorganic hetero-junction, e.g. hetero-junction] [N0605]
- H01L51/05D8 . . . [N: Bi-stable switching devices] [N0906]
- H01L51/05D10 . . . [N: molecular electronic devices (molecular computers [G06F15/80](#); molecular memories [G11C11/00](#), [G11C13/02](#))] [N1108]
- H01L51/10 . . . Details of devices [N9504] [C0607]
- H01L51/10B . . . [N: Electrodes] [N0607]
- H01L51/10B2 [N: Ohmic contacts, e.g. source and drain electrodes] [N0607]
- H01L51/10P . . . [N: Passivation, containers, encapsulations] [N0906]

- H01L51/42 . . . specially adapted for sensing infra-red radiation, light, electro-magnetic radiation of shorter wavelength or corpuscular radiation and adapted for the conversion of the energy of such radiation into electrical energy or for the control of electrical energy by such radiation [N: using organic materials as the active part, or using a combination of organic materials with other material as the active part; Multistep processes for their manufacture] [N0605]
- H01L51/42B . . . [N: Metal-organic semiconductor-metal devices] [N0605]
- H01L51/42D . . . [N: Comprising organic semiconductor-inorganic semiconductor hetero-junctions (H01L51/42H takes precedence)] [N0605]
- H01L51/42D2 . . . [N: Majority carrier devices using sensitisation of widebandgap semiconductors, e.g. TiO₂ (photoelectrochemical devices with a liquid or solid electrolyte H01G9/20)] [N0605]
- H01L51/42D2B [N: the wideband gap semiconductor comprising titanium oxide, e.g. TiO₂] [N0605]
- H01L51/42D2D [N: the wideband gap semiconductor comprising zinc oxide, e.g. ZnO] [N0605]
- H01L51/42F . . . [N: comprising organic semiconductor-organic semiconductor hetero-junctions (H01L51/42H takes precedence)] [N0605]
- H01L51/42F2 . . . [N: comprising multi-junctions, e.g. double hetero-junctions] [N0607]
- H01L51/42H . . . [N: comprising bulk hetero-junctions, e.g. interpenetrating networks] [N0605]
- H01L51/42H2 . . . [N: comprising inorganic nanostructures, e.g. CdSe nano particles] [N0906]
- H01L51/42H2B [N: the inorganic nanostructures being nano-tubes or nano-wires, e.g. CdTe nano-tubes in P3HT] [N0906]
- H01L51/42H6 . . . [N: comprising blocking layers, e.g. exciton blocking layers] [N1108]
- H01L51/42K . . . [N: light sensitive field effect devices] [N0605]
- H01L51/42M . . . [N: Devices having a m-i-s structure] [N1108]
- H01L51/42P . . . [N: Devices having a p-i-n structure] [N1108]
- H01L51/44 . . . Details of devices [N0605] [C0607]

- H01L51/44B . . . [N: Electrodes] [N0607]
- H01L51/44B2 [N: transparent electrodes, e.g. ITO, TCO] [N0607]
- H01L51/44B2B [N: comprising carbon nano-tubes] [N0906]
- H01L51/44B2F [N: comprising arrangements for extracting the current from the cell, e.g. metal finger grid systems to reduce the serial resistance of transparent electrodes] [N0906]
- H01L51/44L . . . [N: Light trapping means] [N0607]
- H01L51/44P . . . [N: Passivation, containers, encapsulations] [N0607]
- H01L51/50 . . specially adapted for light emission, e.g. organic light emitting diodes (OLED) or polymer light emitting devices (PLED); [N: Multistep processes for their manufacture] (organic semiconductor lasers [H01S5/36](#); [N: circuit arrangements for OLED or PLED [H05B33/08P](#); control arrangements for organic electroluminescent displays [G09G3/32A](#)]) [C0810]
- H01L51/50A . . [N: characterised by the interrelation between parameters of constituting active layers, e.g. HOMO-LUMO relation] [N1108]
- H01L51/50B . . [N: Intermediate layers comprising a mixture of materials of the adjoining active layers] [N1108]
- H01L51/50E . . [N: Electroluminescent (EL) layer] [N0308]
- H01L51/50E3 . . . [N: Triplet emission] [N0308]
- H01L51/50E4 . . . [N: comprising active inorganic nanostructures, e.g. luminescent quantum dots] [N1108]
- H01L51/50E5 . . . [N: having a host comprising an emissive dopant and further additive materials, e.g. for improving the dispersability, for improving the stabilisation, for assisting energy transfer] [N1108]
- H01L51/50E5A [N: for assisting energy transfer e.g. sensitization] [N1204]
- H01L51/50E6 . . . [N: Light emitting electrochemical cells (LEC), i.e. with mobile ions in the active layer] [N0308]
- H01L51/50E8 . . . [N: Multi-colour light emission, e.g. colour tuning, polymer blend, stack of electroluminescent layers][N0308]
- H01L51/50E8A [N: Stack of electroluminescent layers] [N1204]
- H01L51/50E8A2 [N: with spacer layers between the emissive layers] [N1204]
- H01L51/50G . . [N: Carrier transporting layer][N0308]
- H01L51/50G2 . . . [N: Doped transporting layer] [N0507]
- H01L51/50G4 . . . [N: Hole transporting layer] [N1204]
- H01L51/50G4B [N: comprising a dopant] [N1204]
- H01L51/50G4C [N: having a multilayered structure] [N1204]
- H01L51/50G4D [N: arranged between the light emitting layer and the cathode] [N1204]
- H01L51/50G6 . . . [N: Electron transporting layer] [N1204]
- H01L51/50G6B [N: comprising a dopant] [N1204]
- H01L51/50G6C [N: having a multilayered structure] [N1204]
- H01L51/50G6D [N: arranged between the light emitting layer and the anode] [N1204]
- H01L51/50J . . [N: Carrier injection layer] [N0308]
- H01L51/50J2 . . . [N: Electron injection layer] [N0308]
- H01L51/50K . . [N: Carrier blocking layer] [N0308]
- H01L51/52 . . Details of devices [N0308]

- H01L51/52B . . . [N: Electrodes] [N0308]
- H01L51/52B2 [N: Anodes, i.e. with high work-function material] [N0308]
- [N: **WARNING**
[N1203] The subgroups of [H01L51/52B2](#) are not complete pending a reorganisation, see provisionally also this group
]
- H01L51/52B2A [N: characterised by the shape] [N1204]
- H01L51/52B2C [N: combined with auxiliary electrode, e.g. ITO layer combined with metal lines] [N1108]
- H01L51/52B2M [N: composed of transparent multilayers] [N1108]
- H01L51/52B2R [N: Reflective anodes, e.g. ITO combined with thick metallic layer] [N1108]
- H01L51/52B4 [N: Cathodes, i.e. with low work-function material] [N0308]
- [N: **WARNING**
[N1203]The subgroups of [H01L51/52B4](#) are not complete pending a reorganisation, see provisionally also this group
]
- H01L51/52B4A [N: characterised by the shape] [N1204]
- H01L51/52B4C [N: combined with auxiliary electrodes] [N1108]
- H01L51/52B4M [N: composed of opaque multilayers] [N1108]
- H01L51/52B4T [N: Transparent, e.g. including thin metal film] [N0711] [C1108]
- H01L51/52C [N: Passivation; Containers; Encapsulation, e.g. against humidity] [N0308]
- [N: **WARNING**
[N1203] The subgroups of [H01L51/52C](#) are not complete pending a reorganisation, see provisionally also this group
]
- H01L51/52C2 [N: Sealing arrangements having a self-supporting structure, e.g. containers] [N1108]
- H01L51/52C2B [N: the sealing arrangements being made of metallic material] [N1108]
- H01L51/52C2C [N: characterised by the peripheral sealing arrangements, e.g. adhesives, sealants] [N1108]
- H01L51/52C2S [N: Vertical spacers, e.g. arranged between the sealing arrangement and the OLED] [N1108]
- H01L51/52C4 [N: Protective coatings] [N1108]
- H01L51/52C4B [N: having repetitive multilayer structures] [N1108]
- H01L51/52C6 [N: including getter material or desiccant] [N1108]
- H01L51/52D [N: Arrangements for extracting light from the device] [N0308] [C0509]
- H01L51/52D2 [N: comprising a resonant cavity structure, e.g. Bragg reflector pair] [N0509]
- H01L51/52D4 [N: Scattering means] [N0509]
- H01L51/52D6 [N: Reflective means] [N0509]
- H01L51/52D8 [N: Refractive means, e.g. lens] [N0509]
- H01L51/52D10 [N: comprising a repetitive electroluminescent unit between one set of electrodes] [N0509]
- H01L51/52E [N: Arrangements for contrast improvement, e.g. preventing reflection of ambient light] [N0308]

- H01L51/52E2 [N: comprising a light absorbing layer, e.g. black layer] [N0509]
- H01L51/52F [N: OLED having a fiber structure] [N1108]
- H01L51/52H [N: Arrangements for heating or cooling] [N0308]
- H01L51/52P [N: Arrangements for polarized light emission ([H01L51/52E](#) takes precedence)]
[N0308] [C1108]
- H01L51/52T [N: Light emitting organic transistors] [N1108]
- H01L51/56 Processes or apparatus specially adapted for the manufacture or treatment of such
devices or of parts thereof [N0902]