COOPERATIVE PATENT CLASSIFICATION

H  ELECTRICITY
   (NOTE omitted)

H01  BASIC ELECTRIC ELEMENTS
   (NOTE omitted)

H01L  SEMICONDUCTOR DEVICES; ELECTRIC SOLID STATE DEVICES NOT OTHERWISE PROVIDED FOR (use of semiconductor devices for measuring G01; resistors in general H01C; magnets, inductors, transformers H01F; capacitors in general H01G; electrolytic devices H01G 9/00; 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 electrical apparatus, manufacture of assemblies of electrical components H05K; use of semiconductor devices in circuits having a particular application, see the subclass for the application)

NOTES

1. This subclass covers:
   • electric solid state devices which are not covered by any other subclass and details thereof, and 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;
   • photoresistors, magnetic field dependent resistors, field effect resistors, capacitors with potential-jump barrier, resistors with potential-jump barrier or surface barrier, incoherent light emitting diodes and thin-film or thick-film circuits;
   • 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 following terms or expressions are used with the meaning indicated:
   • "wafer" means a slice of semiconductor or crystalline substrate material, which can be modified by impurity diffusion (doping), ion implantation or epitaxy, and whose active surface can be processed into arrays of discrete components or integrated circuits;
   • "solid state body" means 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. An electrode may include several portions and the term includes metallic regions which exert an 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;
   • "device" means an electric circuit element; where an electric circuit element is one of a plurality of elements formed in or on a common substrate it is referred to as a "component";
   • "complete device" is a device in its fully assembled state which may or may not require further treatment, e.g. electroforming, before it is ready for use but which does not require the addition of further structural units;
   • "parts" includes all structural units which are included in a complete device;
   • "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;
   • "assembly" of a device is the building up of the device from its component constructional units and includes the provision of fillings in containers.

3. In this subclass, both the process or apparatus for the manufacture or treatment of a device and the device itself are classified, whenever both of these are described sufficiently to be of interest.
4. Attention is drawn to Note (3) after the title of section C, which Note indicates to which version of the periodic table of chemical elements the IPC refers. In this subclass, the Periodic System used is the 8 group system indicated by Roman numerals in the Periodic Table thereunder.

WARNINGS

1. The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following CPC groups:

<table>
<thead>
<tr>
<th>IPC Group</th>
<th>Covered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>H01L 21/301</td>
<td>H01L 21/30</td>
</tr>
<tr>
<td>H01L 21/328</td>
<td>H01L 29/66075</td>
</tr>
<tr>
<td>H01L 21/329</td>
<td>H01L 29/66083</td>
</tr>
<tr>
<td>H01L 21/33</td>
<td>H01L 29/66227</td>
</tr>
<tr>
<td>H01L 21/331</td>
<td>H01L 29/66334</td>
</tr>
<tr>
<td>H01L 21/332</td>
<td>H01L 29/66363</td>
</tr>
<tr>
<td>H01L 21/334</td>
<td>H01L 29/66075</td>
</tr>
<tr>
<td>H01L 21/335</td>
<td>H01L 29/66409</td>
</tr>
<tr>
<td>H01L 21/336</td>
<td>H01L 29/66893</td>
</tr>
<tr>
<td>H01L 21/337</td>
<td>H01L 29/66477</td>
</tr>
<tr>
<td>H01L 21/338</td>
<td>H01L 29/66848</td>
</tr>
<tr>
<td>H01L 21/339</td>
<td>H01L 29/66946</td>
</tr>
<tr>
<td>H01L 21/36-H01L 21/368</td>
<td>H01L 21/02107</td>
</tr>
<tr>
<td>H01L 21/58</td>
<td>H01L 24/80</td>
</tr>
<tr>
<td>H01L 21/60</td>
<td>H01L 21/50, H01L 2021/60</td>
</tr>
<tr>
<td>H01L 21/66</td>
<td>H01L 22/00</td>
</tr>
<tr>
<td>H01L 21/603</td>
<td>H01L 21/50, H01L 2021/603</td>
</tr>
<tr>
<td>H01L 21/607</td>
<td>H01L 21/50, H01L 2021/607</td>
</tr>
<tr>
<td>H01L 21/8242</td>
<td>H01L 27/108</td>
</tr>
<tr>
<td>H01L 21/8244</td>
<td>H01L 27/11</td>
</tr>
<tr>
<td>H01L 21/8246</td>
<td>H01L 27/112</td>
</tr>
<tr>
<td>H01L 21/98</td>
<td>H01L 25/50</td>
</tr>
<tr>
<td>H01L 29/38</td>
<td>H01L 29/04-H01L 29/365</td>
</tr>
<tr>
<td>H01L 29/96</td>
<td>H01L 29/68-H01L 29/945</td>
</tr>
<tr>
<td>H01L 51/30</td>
<td>H01L 51/0032</td>
</tr>
<tr>
<td>H01L 51/40</td>
<td>H01L 51/0001</td>
</tr>
<tr>
<td>H01L 51/46</td>
<td>H01L 51/0032</td>
</tr>
<tr>
<td>H01L 51/48</td>
<td>H01L 51/0001</td>
</tr>
<tr>
<td>H01L 51/54</td>
<td>H01L 51/0032</td>
</tr>
</tbody>
</table>

2. In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

21/00 Processes or apparatus adapted for the manufacture or treatment of semiconductor or solid state devices or of parts thereof (testing or measuring during manufacture or treatment, or reliability measurements H01L 22/00; multistep manufacturing processes for passive two-terminal components without a potential-jump or surface barrier for integrated circuits H01L 28/00; ) processes or apparatus peculiar to the manufacture or treatment of devices provided for in groups H01L 31/00-H01L 51/00 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

21/02 Manufacturing or treatment of semiconductor devices or of parts thereof

21/0200 (Preparing wafers)

NOTES

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 H01L 21/02041).

2. This group does not cover:
   - simple use of grinding or polishing machines B24B
   - thermal smoothening H01L 21/324

21/02005 [Preparing bulk and homogeneous wafers]
21/02008 [Multistep processes]
21/0201 [Specific process step]
21/02013 [Grinding, lapping]
21/02016 [Backside treatment]
21/02019 [Chemical etching]
21/02021 [Edge treatment, chamfering]
21/02024 [Mirror polishing]
21/02027 [Setting crystal orientation]
21/0203 [Making porous regions on the surface]
21/02032 [by reclaiming or re-processing]
21/02035 [Shaping]
21/02041 [Cleaning]
21/02043 [Cleaning before device manufacture, i.e. Begin-Of-Line process]
21/02046 [Dry cleaning only (H01L 21/02085 takes precedence)]
21/02049 [with gaseous HF]
21/02052 [Wet cleaning only (H01L 21/02085 takes precedence)]
H01L

WARNING

Groups H01L 21/02063 – H01L 21/022 are incomplete pending reclassification of documents from groups H01L 21/02063, H01L 21/02065, and H01L 21/02068.

WARNING

Groups H01L 21/02063 – H01L 21/022 are incomplete pending reclassification of documents from groups H01L 21/02063, H01L 21/02065, and H01L 21/02068.

WARNING

Groups H01L 21/02063 – H01L 21/022 are incomplete pending reclassification of documents from groups H01L 21/02063, H01L 21/02065, and H01L 21/02068.

H01L 21/0215 . . . . . . . . . . (the material being carbon, e.g. alpha-C, diamond or hydrogen doped carbon)

H01L 21/0218 . . . . . . . . . . (carbon based polymeric organic or inorganic material, e.g. polymides, poly cyclobutene or PVC (polymers per se, photoresists per se, fluoropolymers))

H01L 21/02112 . . . . . . . . . . [the material being fluoro carbon compounds, e.g. (CFx)n, (CHFx)n or polytetrafluoroethylene]

H01L 21/02123 . . . . . . . . . . (the material containing silicon)

H01L 21/02126 . . . . . . . . . . (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)

H01L 21/02129 . . . . . . . . . . (the material being boron or phosphorus doped silicon oxides, e.g. BPSG, BSG or PSG)

NOTE

Halogen, e.g. fluorine, containing BPSG, BSG, PSG, and the like, are additionally classified in H01L 21/02131

H01L 21/02131 . . . . . . . . . . (the material being halogen doped silicon oxides, e.g. FSG)

H01L 21/02134 . . . . . . . . . . (the material comprising hydrogen silsesquioxane, e.g. HSQ)

H01L 21/02137 . . . . . . . . . . (the material comprising alkyl silsesquioxane, e.g. MSQ)

H01L 21/0214 . . . . . . . . . . (the material being a silicon oxynitride, e.g. SiON or SiON:H)

H01L 21/02142 . . . . . . . . . . (the material containing silicon and at least one metal element, e.g. metal silicate based insulators or metal silicon oxynitrides)

H01L 21/02145 . . . . . . . . . . (the material containing aluminium, e.g. AlSiOx)

H01L 21/02148 . . . . . . . . . . (the material containing hafnium, e.g. HfSiOx or HfSiON)

H01L 21/0215 . . . . . . . . . . (the material containing tantalum, e.g. TaSiOx)

H01L 21/02153 . . . . . . . . . . (the material containing titanium, e.g. TiSiOx)

H01L 21/02156 . . . . . . . . . . (the material containing at least one rare earth element, e.g. silicate of lanthanides, scandium or yttrium)

H01L 21/02159 . . . . . . . . . . (the material containing zirconium, e.g. ZrSiOx)

H01L 21/02161 . . . . . . . . . . (the material containing more than one metal element)

H01L 21/02164 . . . . . . . . . . (the material being a silicon oxide, e.g. SiO2)

NOTE

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 H01L 21/02126 and subgroups: deposition of silicon oxide from organic precursors without further statements on film
H01L

H01L 21/02164 (continued)

composition is classified here and in H01L 21/02205 and subgroups

21/02167 . . . . . . . . [the material being a silicon carbide not containing oxygen, e.g. SiC, SiC:H or silicon carbonitrides (H01L 21/02126 and H01L 21/0214 take precedence)]

21/0217 . . . . . . . . [the material being a silicon nitride not containing oxygen, e.g. SixNy or SixByNz (H01L 21/02126 and H01L 21/0214 take precedence)]

21/02172 . . . . . . . . [the material containing at least one metal element, e.g. metal oxides, metal nitrides, metal oxynitrides or metal carbides (materials containing silicon H01L 21/02123; metal silicates H01L 21/02142)]

21/02175 . . . . . . . . [characterised by the metal (H01L 21/02197 takes precedence)]

21/02178 . . . . . . . . [the material containing aluminium, e.g. Al2O3]

21/02181 . . . . . . . . [the material containing hafnium, e.g. HfO2]

21/02183 . . . . . . . . [the material containing tantalum, e.g. Ta2O5]

21/02186 . . . . . . . . [the material containing titanium, e.g. TiO2]

21/02189 . . . . . . . . [the material containing zirconium, e.g. ZrO2]

21/02192 . . . . . . . . [the material containing at least one rare earth metal element, e.g. oxides of lanthanides, scandium or yttrium]

21/02194 . . . . . . . . [the material containing more than one metal element]

21/02197 . . . . . . . . [the material having a perovskite structure, e.g. BaTiO3]

21/022 . . . . . . . . [the layer being a laminate, i.e. composed of sublayers, e.g. stacks of alternating high-k metal oxides (adhesion layers or buffer layers H01L 21/02304, H01L 21/0262)]

21/02203 . . . . . . . . [the layer being porous]

21/02205 . . . . . . . . [the layer being characterised by the precursor material for deposition]

21/02208 . . . . . . . . [the precursor containing a compound comprising Si]

21/02211 . . . . . . . . [the compound being a silane, e.g. disilane, methylsilane or chlorosilane]

21/02214 . . . . . . . . [the compound comprising silicon and oxygen]

NOTE

This group does not cover mixtures of silane and oxygen

21/02216 . . . . . . . . [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]

21/02219 . . . . . . . . [the compound comprising silicon and nitrogen]

NOTE

This group does not cover mixtures of silane and nitrogen

21/0222 . . . . . . . . [the compound being a silazane]

21/02225 . . . . . . . . [characterised by the process for the formation of the insulating layer]

21/02227 . . . . . . . . [formation by a process other than a deposition process]

NOTE

Subject matter classified in the range of H01L 21/02223 - H01L 21/02249 is additionally classified in H01L 21/02249, H01L 21/02255 and H01L 21/02252, depending on the type of reaction

21/0223 . . . . . . . . [formation by oxidation, e.g. oxidation of the substrate]

21/02233 . . . . . . . . [of the semiconductor substrate or a semiconductor layer]

21/02236 . . . . . . . . [group IV semiconductor]

21/02238 . . . . . . . . [silicon in uncombined form, i.e. pure silicon]

21/02241 . . . . . . . . [III-V semiconductor]

21/02244 . . . . . . . . [of a metallic layer]

21/02247 . . . . . . . . [formation by nitridation, e.g. nitridation of the substrate]

21/02249 . . . . . . . . [formation by combined oxidation and nitridation performed simultaneously]

21/02252 . . . . . . . . [formation by plasma treatment, e.g. plasma oxidation of the substrate (after treatment of an insulating film by plasma H01L 21/3105 and subgroups)]

21/02255 . . . . . . . . [formation by thermal treatment (H01L 21/02252 takes precedence; after treatment of an insulating film H01L 21/3105 and subgroups)]

21/02258 . . . . . . . . [formation by anodic treatment, e.g. anodic oxidation]

21/0226 . . . . . . . . [formation by a deposition process (per se C23C)]

21/02263 . . . . . . . . [deposition from the gas or vapour phase]

NOTE

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

21/02266 . . . . . . . . [deposition by physical ablation of a target, e.g. sputtering, reactive sputtering, physical vapour deposition or pulsed laser deposition]
21/02269 . . . . . . . {deposition by thermal evaporation (H01L 21/02293 takes precedence)}

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

21/02271 . . . . . . . {deposition by decomposition or reaction of gaseous or vapour phase compounds, i.e. chemical vapour deposition (H01L 21/02266 takes precedence)}

21/02274 . . . . . . . {in the presence of a plasma [PECVD]}

21/02277 . . . . . . . {the reactions being activated by other means than plasma or thermal, e.g. photo-CVD}

21/0228 . . . . . . . {deposition by cyclic CVD, e.g. ALD, ALE, pulsed CVD}

NOTE
Subject matter relating to cyclic plasma CVD is additionally classified in H01L 21/02274

21/02282 . . . . . . . {liquid deposition, e.g. spin-coating, sol-gel techniques, spray coating}

21/02285 . . . . . . . {Langmuir-Blodgett techniques}

21/02288 . . . . . . . {printing, e.g. ink-jet printing (per se B41J)}

21/0229 . . . . . . . {liquid atomic layer deposition}

21/02293 . . . . . . . {formation of epitaxial layers by a deposition process (epitaxial growth per se C30B)}

NOTE
Formation of non-epitaxial layers by MBE, ALE, etc. is not covered by this group; for MBE see H01L 21/02269; for ALE see H01L 21/0228

21/02296 . . . . . . . {characterised by the treatment performed before or after the formation of the layer (H01L 21/02227 and subgroups take precedence)}

NOTE
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 H01L 21/02041 and subgroups; for etching processes see H01L 21/311 and subgroups; for planarization processes see H01L 21/3105 and subgroups; for processes to repair etch damage see H01L 21/3105 and subgroups

21/02299 . . . . . . . {pre-treatment}

NOTE
This group and subgroups cover treatments to improve adhesion or change the surface termination; for etching see H01L 21/306 and subgroups and H01L 21/311 and subgroups

21/02301 . . . . . . . {in-situ cleaning}

NOTE
Subject matter relating to the cleaning processes for semiconductor devices in general is covered by H01L 21/02041 and subgroups

21/02304 . . . . . . . {formation of intermediate layers, e.g. buffer layers, layers to improve adhesion, lattice match or diffusion barriers}

21/02307 . . . . . . . {treatment by exposure to a liquid}

21/0231 . . . . . . . {treatment by exposure to electromagnetic radiation, e.g. UV light}

21/02312 . . . . . . . {treatment by exposure to a gas or vapour}

21/02315 . . . . . . . {treatment by exposure to a plasma}

21/02318 . . . . . . . {post-treatment}

NOTE
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 H01L 21/3105 and subgroups

21/02321 . . . . . . . {introduction of substances into an already existing insulating layer (H01L 21/02227 and subgroups take precedence)}

NOTE
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 H01L 21/02337, H01L 21/02343, H01L 21/02345 and subgroups

21/02323 . . . . . . . {introduction of oxygen}

21/02326 . . . . . . . {into a nitride layer, e.g. changing SiN to SiON}

21/02329 . . . . . . . {introduction of nitrogen}

21/02332 . . . . . . . {into an oxide layer, e.g. changing SiO to SiON}

21/02334 . . . . . . . {in-situ cleaning after layer formation, e.g. removing process residues}

NOTE
Subject matter relating to the cleaning processes for semiconductor
WARNING

Group H01L 21/02365 is incomplete pending reclassification of documents from groups H01L 21/06, H01L 21/16, and H01L 21/20.

Groups H01L 21/06, H01L 21/16, and H01L 21/20 should be considered in order to perform a complete search.
H01L

21/02566 . . . . . . {Oxide semiconducting materials not being Group 12/16 materials, e.g. ternary compounds}
21/02568 . . . . . . {Chalcogenide semiconducting materials not being oxides, e.g. ternary compounds}
21/0257 . . . . . . {Doping during depositing}
21/02573 . . . . . . {Conductivity type}
21/02576 . . . . . . {N-type}
21/02579 . . . . . . {P-type}
21/02581 . . . . . . {Transition metal or rare earth elements}
21/02584 . . . . . . {Delta-doping}
21/02587 . . . . . . {Structure}
21/0259 . . . . . . {Microstructure}
21/02592 . . . . . . {amorphous}
21/02595 . . . . . . {polycrystalline}
21/02598 . . . . . . {monocrystalline}
21/02601 . . . . . . {Nanoparticles (fullerenes H01L 51/0046)}
21/02603 . . . . . . {Nanowires}
21/02606 . . . . . . {Nanotubes (carbon nanotubes H01L 51/0048)}
21/02609 . . . . . . {Crystal orientation}
21/02612 . . . . . . {Formation types}
21/02614 . . . . . . {Transformation of metal, e.g. oxidation, nitridation}
21/02617 . . . . . . {Deposition types}
21/0262 . . . . . . {Reduction or decomposition of gaseous compounds, e.g. CVD}
21/02623 . . . . . . {Liquid deposition}
21/02625 . . . . . . {using melted materials}
21/02628 . . . . . . {using solutions}
21/02631 . . . . . . {Physical deposition at reduced pressure, e.g. MBE, sputtering, evaporation}
21/02634 . . . . . . {Homoeptaxy}
21/02636 . . . . . . {Selective deposition, e.g. simultaneous growth of mono- and non-monocrystalline semiconductor materials}
21/02639 . . . . . . {Preparation of substrate for selective deposition}
21/02642 . . . . . . {Mask materials other than SiO or SiN}
21/02645 . . . . . . {Seed materials}
21/02647 . . . . . . {Lateral overgrowth}
21/0265 . . . . . . {Pendeoepitaxy}
21/02653 . . . . . . {Vapour epitaxy}
21/02656 . . . . . . {Special treatments}
21/02658 . . . . . . {Pretreatments (cleaning in general H01L 21/0241)}
21/02661 . . . . . . {In-situ cleaning}
21/02664 . . . . . . {Aftertreatments (planarisation in general H01L 21/304)}
21/02667 . . . . . . {Crystallisation or recrystallisation of non-monocrystalline semiconductor materials, e.g. regrowth}
21/02669 . . . . . . {using crystallisation inhibiting elements}
21/02672 . . . . . . {using crystallisation enhancing elements}
21/02675 . . . . . . {using laser beams}
21/02678 . . . . . . {Beam shaping, e.g. using a mask}
21/0268 . . . . . . {Shape of mask}
21/02683 . . . . . . {Continuous wave laser beam}
21/02686 . . . . . . {Pulsed laser beam}
21/02689 . . . . . . {using particle beams}
21/02691 . . . . . . {Scanning of a beam}
21/02694 . . . . . . {Controlling the interface between substrate and epilayer, e.g. by ion implantation followed by annealing}
21/02697 . . . . . . {Forming conducting materials on a substrate}
21/027 . . . . . . {Making masks on semiconductor bodies for further photolithographic processing not provided for in group H01L 21/18 or H01L 21/34 (photographic masks or originals per se G03F 1/00; registration or positioning of photographic masks or originals G03F 9/00; photographic cameras G03B; control of position G05D 3/00)}
21/0271 . . . . . . {comprising organic layers}
21/0272 . . . . . . {for lift-off processes}
21/0273 . . . . . . {characterised by their composition, e.g. multilayer masks, materials}
21/0274 . . . . . . {Photolithographic processes}
21/0275 . . . . . . {using lasers}
21/0276 . . . . . . {using an anti-reflective coating (anti-reflective coating for lithography in general G03F 7/09)}
21/0277 . . . . . . {Electrolithographic processes}
21/0278 . . . . . . {Röntgenlithographic or X-ray lithographic processes}
21/0279 . . . . . . {Ionlithographic processes}
21/033 . . . . . . {comprising inorganic layers}
21/0331 . . . . . . {for lift-off processes}
21/0332 . . . . . . {characterised by their composition, e.g. multilayer masks, materials}
21/0334 . . . . . . {characterised by their size, orientation, disposition, behaviour, shape, in horizontal or vertical plane}
21/0335 . . . . . . {characterised by their behaviour during the process, e.g. soluble masks, redeposited masks}
21/0337 . . . . . . {characterised by the process involved to create the mask, e.g. lift-off masks, sidewalls, or to modify the mask, e.g. pretreatment, post-treatment}
21/0338 . . . . . . {Process specially adapted to improve the resolution of the mask}
21/04 . . . . . . {the devices having at least one potential-jump barrier or surface barrier, e.g. PN junction, depletion layer or carrier concentration layer (multistep manufacturing processes for semiconductor bodies of said devices H01L 29/401; multistep manufacturing processes for electrodes of said devices H01L 29/402; multistep manufacturing processes for said devices H01L 29/6607)}
21/0405 . . . . . . {the devices having semiconductor bodies comprising semiconducting carbon, e.g. diamond, diamond-like carbon (multistep processes for the manufacture of said devices H01L 29/66015)}

NOTE
This group covers passivation
21/041 . . . . . [Making n- or p-doped regions]
21/0415 . . . . . [using ion implantation]
21/042 . . . . . [Changing their shape, e.g. forming recesses (etching of the semiconductor body H01L 21/302)]
21/0425 . . . . . [Making electrodes]
21/043 . . . . . [Ohmic electrodes]
21/0435 . . . . . [Schottky electrodes]
21/044 . . . . . [Conductor-insulator-semiconductor electrodes]
21/0445 . . . . . [the devices having semiconductor bodies comprising crystalline silicon carbide (multistep processes for the manufacture of said devices H01L 29/66053)]
21/045 . . . . . [passivating silicon carbide surfaces]
21/0455 . . . . . [Making n or p doped regions or layers, e.g. using diffusion]
21/046 . . . . . [using ion implantation]

**NOTE**
Processes where ion implantation of boron and subsequent annealing does not produce a p-doped region are classified elsewhere, e.g. H01L 21/0445

21/0465 . . . . . [using masks]
21/047 . . . . . [characterised by the angle between the ion beam and the crystal planes or the main crystal surface]
21/0475 . . . . . [Changing the shape of the semiconductor body, e.g. forming recesses, (etching of the semiconductor body H01L 21/302)]
21/048 . . . . . [Making electrodes]
21/0485 . . . . . [Ohmic electrodes]
21/049 . . . . . [Conductor-insulator-semiconductor electrodes, e.g. MIS contacts]
21/0495 . . . . . [Schottky electrodes]
21/06 . . . . . [the devices having semiconductor bodies comprising selenium or tellurium in uncombined form other than as impurities in semiconductor bodies of other materials]

**WARNING**
Group H01L 21/06 is impacted by reclassification into groups H01L 21/02365 – H01L 21/02694.

Groups H01L 21/06 and H01L 21/02365 – H01L 21/02694 should be considered in order to perform a complete search.

21/08 . . . . . [Preparation of the foundation plate]
21/09 . . . . . [Lithography]
21/092 . . . . . [vaporisation]
21/10 . . . . . [Lithography]
21/101 . . . . . [Application of the selenium or tellurium to the foundation plate]
21/1015 . . . . . [using ion implantation]
21/102 . . . . . [Joining of semiconductor bodies for junction formation]
21/103 . . . . . [Conversion of the selenium or tellurium to the conductive state]
21/104 . . . . . [Application of a non-genetic conductive layer]
21/105 . . . . . [Passivation and recombination]
21/1055 . . . . . [by recombination]
21/106 . . . . . [Joining of semiconductor bodies for junction formation]
21/107 . . . . . [Formation of a barrier layer]
21/108 . . . . . [Passivation of the surface of the selenium or tellurium layer after having been made conductive]
21/1085 . . . . . [using ion implantation]

**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 Group IV of the Periodic System or A$_3$B$_5$ compounds, even if the material used is not explicitly specified.

21/18 . . . . . [the devices having semiconductor bodies comprising elements of Group IV of the Periodic System or A$_3$B$_5$ compounds, with or without impurities, e.g. doping materials { ( H01L 21/041 - H01L 21/0425, H01L 21/045 - H01L 21/048 take precedence) }]

21/19 . . . . . [Treatment of the complete device, e.g. by electroforming, ageing]
21/192 . . . . . [Electroforming to form a barrier layer]
21/193 . . . . . [Using materials or coating the foundation plate]
21/195 . . . . . [Formation of a barrier layer]
21/196 . . . . . [Passivation of the surface of the selenium or tellurium after having been made conductive]
21/197 . . . . . [Joining of semiconductor bodies for junction formation]
21/198 . . . . . [Formation of a barrier layer]
21/199 . . . . . [Using materials or coating the foundation plate]
21/20 . . . . . [Deposition of semiconductor materials on a substrate, e.g. epitaxial growth [solid phase epitaxy]]

**WARNING**
Group H01L 21/20 is impacted by reclassification into groups H01L 21/02365 – H01L 21/02694.

Groups H01L 21/20 and H01L 21/02365 – H01L 21/02694 should be considered in order to perform a complete search.
21/2003 . . . . . . . (Characterised by the substrate (H01L 21/203, H01L 21/205, H01L 21/208 take precedence))
21/2007 . . . . . . . {Bonding of semiconductor wafers to insulating substrates or to semiconducting substrates using an intermediate insulating layer (H01L 21/2011 takes precedence; bonding of semiconductor wafers to semiconductor wafers for junction formation H01L 21/2177)}
21/2011 . . . . . . . {the substrate being of crystalline insulating material, e.g. sapphire}
21/2015 . . . . . . . {the substrate being of crystalline semiconductor material, e.g. lattice adaptation, heteroepitaxy}
21/2018 . . . . . . . {Selective epitaxial growth, e.g. simultaneous deposition of mono- and non-mono semiconductor materials}
21/2022 . . . . . . . {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}
21/2026 . . . . . . . {using a coherent energy beam, e.g. laser or electron beam}
21/203 . . . . . . . using physical deposition, e.g. vacuum deposition, sputtering
21/2033 . . . . . . . {Epitaxial deposition of elements of Group IV of the Periodic System, e.g. Si, Ge}
21/2036 . . . . . . . {Epitaxial deposition of AIII BV compounds}
21/205 . . . . . . . using reduction or decomposition of a gaseous compound yielding a solid condensate, i.e. chemical deposition
21/2053 . . . . . . . {Epitaxial deposition of elements of Group IV of the Periodic System, e.g. Si, Ge}
21/2056 . . . . . . . {Epitaxial deposition of AIII BV compounds}
21/208 . . . . . . . using liquid deposition
21/2085 . . . . . . . {Epitaxial deposition of AIII BV compounds}
21/22 . . . . . . . Diffusion of impurity materials, e.g. doping materials, electrode materials, into or out of a semiconductor body, or between semiconductor regions; {Interactions between two or more impurities; Redistribution of impurities}
21/2205 . . . . . . . {from the substrate during epitaxy, e.g. autodoping; Preventing or using autodoping}
21/221 . . . . . . . (of killers)
21/2215 . . . . . . . {in AIII BV compounds}
21/222 . . . . . . . {Lithium-drift}
21/2225 . . . . . . . {Diffusion sources}
21/223 . . . . . . . using diffusion into or out of a solid from or into a gaseous phase (H01L 21/221 - H01L 21/222 take precedence; diffusion through an applied layer H01L 21/225)}
21/2233 . . . . . . . {Diffusion into or out of AIII BV compounds}
21/2236 . . . . . . . {from or into a plasma phase}
21/225 . . . . . . . using diffusion into or out of a solid from or into a solid phase, e.g. a doped oxide layer (H01L 21/221 - H01L 21/222 take precedence)
21/2251 . . . . . . . {Diffusion into or out of group IV semiconductors}
21/2252 . . . . . . . {using predeposition of impurities into the semiconductor surface, e.g. from a gaseous phase}
21/2253 . . . . . . . {by ion implantation}

**NOTE**

In groups H01L 21/254 - H01L 21/257 one should consider the main compositional parts of the applied layer just before the diffusion step.

21/2254 . . . . . . . {from or through or into an applied layer, e.g. photore sist, nitrides}
21/2255 . . . . . . . {the applied layer comprising oxides only, e.g. P2O5, PSG, HfBO3, doped oxides}
21/2256 . . . . . . . {through the applied layer}
21/2257 . . . . . . . {the applied layer being silicon or silicide or SIPOS, e.g. polysilicon, porous silicon}
21/2258 . . . . . . . {Diffusion into or out of AIII BV compounds}
21/228 . . . . . . . using diffusion into or out of a solid from or into a liquid phase, e.g. alloy diffusion processes (H01L 21/221 - H01L 21/222 take precedence)
21/24 . . . . . . . Alloying of impurity materials, e.g. doping materials, electrode materials, with a semiconductor body {(H01L 21/182 takes precedence)}
21/242 . . . . . . . {Alloying of doping materials with AIII BV compounds}
21/244 . . . . . . . {Alloying of electrode materials}
21/246 . . . . . . . {with AIII BV compounds}
21/248 . . . . . . . {Apparatus specially adapted for the alloying}
21/26 . . . . . . . Bombardment with radiation (H01L 21/3105 takes precedence)
21/2605 . . . . . . . {using natural radiation, e.g. alpha, beta or gamma radiation}
21/261 . . . . . . . to produce a nuclear reaction transmuting chemical elements
21/263 . . . . . . . with high-energy radiation (H01L 21/261 takes precedence)
21/2633 . . . . . . . {for etching, e.g. sputter etching}
21/2636 . . . . . . . {for heating, e.g. electron beam heating}
producing ion implantation (ion beam tubes for localised treatment, H01J 37/30)

**WARNING**

Groups H01L 21/26566, H01L 21/2658 and H01L 21/26593 are incomplete pending reclassification of documents from groups H01L 21/26506 and H01L 21/2654.

Groups H01L 21/26566, H01L 21/2658, H01L 21/26593, H01L 21/26506 and H01L 21/2654 should be considered in order to perform a complete search.

{characterised by the conductor (H01L 21/28176 takes precedence)}

**NOTE**

When the final conductor comprises a superconductor, subject matter is not classified according to the subgroups H01L 21/28035 - H01L 21/28097. Instead, it is classified in H01L 21/28026.

{the final conductor layer next to the insulator being silicon, e.g. polysilicon, with or without impurities (H01L 21/28105 takes precedence)}

**NOTE**

A very thin, e.g. silicon, adhesion or seed layer is not considered as the one next to the insulator.

{the conductor comprising at least another non-silicon conductive layer}

{the conductor comprising a silicide layer formed by the silicidation reaction of silicon with a metal layer (formed by metal ion implantation H01L 21/28044)}

{the conductor comprising a metal or metallic silicide formed by deposition, e.g. sputter deposition, i.e. without a silicidation reaction (H01L 21/28052 takes precedence)}

**NOTE**

To assess the coverage of groups H01L 21/28052 and H01L 21/28061, barrier layers, e.g. TaSiN, are not considered.

{the final conductor layer next to the insulator being Si or Ge or C and their alloys except Si}

{the final conductor layer next to the insulator being a single metal, e.g. Ta, W, Mo, Al}

{the final conductor layer next to the insulator being a composite, e.g. TiN}

{the final conductor layer next to the insulator having a lateral composition or doping variation, or being formed laterally by more than one deposition step}
Making the insulator
oxidation, e.g. using a liquid, i.e. chemical
on single crystalline silicon, isolation; Planarisation aspects

{ conducting part of electrode is defined by a sidewall spacer or a similar technique, e.g. oxidation under mask, plating}

{ 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}

{ part or whole of the electrode is a sidewall spacer or made by a similar technique, e.g. transformation under mask, plating}

{ Making the insulator}

{ on single crystalline silicon, e.g. using a liquid, i.e. chemical oxidation}

{ with a treatment, e.g. annealing, after the formation of the definitive gate conductor}

{ with a treatment, e.g. annealing, after the formation of the gate insulator and before the formation of the definitive gate conductor}

{ by deposition, e.g. evaporation, ALD, CVD, sputtering, laser deposition (H01L 21/28202 takes precedence)}

{ in a nitrogen-containing ambient, e.g. nitride deposition, growth, oxynitridation, NH₃ nitridation, N₂O oxidation, thermal nitridation, RTN, plasma nitridation, RPN}

{ in a gaseous ambient using an oxygen or a water vapour, e.g. RTO, possibly through a layer (H01L 21/28194 and H01L 21/28202 take precedence)}

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

NOTE Documents are also classified in groups H01L 21/28035 - H01L 21/28104 when the composition is also relevant

Deposition of conductive or insulating materials for electrodes [conducting electric current]

from a gas or vapour, e.g. condensation

[ of conductive layers]

[ on semiconductor bodies comprising elements of Group IV of the Periodic System]

[ the conductive layers comprising silicides (H01L 21/2837 takes precedence)]

[ the conductive layers comprising semiconducting material (H01L 21/2818, H01L 21/2837 take precedence)]

[ Making of side-wall contacts]

[ Deposition of Schottky electrodes]

[ on semiconductor bodies comprising diamond]

[ by physical means, e.g. sputtering, evaporation (H01L 21/2818 - H01L 21/2837 and H01L 21/2868 take precedence)]

[ by chemical means, e.g. CVD, LPCVD, PECVD, laser CVD (H01L 21/2818 - H01L 21/2837 and H01L 21/2868 take precedence)]

[ Selective deposition]

[ the conductive layers comprising transition metals (H01L 21/2818 takes precedence)]

[ on semiconductor bodies comprising A₃B₅ compounds]

[ Deposition of Schottky electrodes]

[ characterised by the sectional shape, e.g. T, inverted T]

[ asymmetrical sectional shape]

from a liquid, e.g. electrolytic deposition
H01L

21/2885 . . . . [using an external electrical current, i.e. electro-deposition]
21/30 . . . . Treatment of semiconductor bodies using processes or apparatus not provided for in groups H01L 21/20 - H01L 21/26 (manufacture of electrodes thereon H01L 21/28)
21/3003 . . . . [Hydrogenation or deuterisation, e.g. using atomic hydrogen from a plasma]
21/3006 . . . . {of $A_B$ compounds]
21/302 . . . . to change their surface-physical characteristics or shape, e.g. etching, polishing, cutting
21/304 . . . . Mechanical treatment, e.g. grinding, polishing, cutting ((H01L 21/30625 takes precedence))
21/3043 . . . . [Making grooves, e.g. cutting]
21/3046 . . . . [using blasting, e.g. sand-blasting (H01L 21/2633 takes precedence)]
21/306 . . . . Chemical or electrical treatment, e.g. electrolytic etching (to form insulating layers H01L 21/31)
21/30604 . . . . [Chemical etching]
21/30608 . . . . {Anisotropic liquid etching (H01L 21/3063 takes precedence)}
21/30612 . . . . [Etching of $A_B$ compounds]
21/30617 . . . . {Anisotropic liquid etching}
21/30621 . . . . [Vapour phase etching]
21/30625 . . . . [With simultaneous mechanical treatment, e.g. mechanico-chemical polishing]
21/3063 . . . . Electrolytic etching
21/30635 . . . . {of $A_B$ compounds]
21/3065 . . . . Plasma etching; Reactive-ion etching
21/30655 . . . . [comprising alternated and repeated etching and passivation steps, e.g. Bosch process]
21/308 . . . . using masks (H01L 21/3063, H01L 21/3065 take precedence)
21/3081 . . . . [characterised by their composition, e.g. multilayer masks, materials]
21/3083 . . . . [characterised by their size, orientation, disposition, behaviour, shape, in horizontal or vertical plane]
21/3085 . . . . [characterised by their behaviour during the process, e.g. soluble masks, redeposited masks]
21/3086 . . . . [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]
21/3088 . . . . [Process specially adapted to improve the resolution of the mask]
21/31 . . . . to form insulating layers thereon, e.g. for masking or by using photolithographic techniques (layers forming electrodes H01L 21/28; encapsulating layers H01L 21/56); After treatment of these layers
21/3105 . . . . After-treatment

21/31051 . . . . [Planarisation of the insulating layers (H01L 21/31058 takes precedence)]
21/31053 . . . . [involving a dielectric removal step]
21/31055 . . . . [the removal being a chemical etching step, e.g. dry etching (etching per se H01L 21/311)]
21/31056 . . . . [the removal being a selective chemical etching step, e.g. selective dry etching through a mask]
21/31058 . . . . {of organic layers]
21/311 . . . . Etching the insulating layers {by chemical or physical means (H01L 21/31058 takes precedence)}
21/31105 . . . . [Etching inorganic layers]
21/31111 . . . . [by chemical means]
21/31138 . . . . [by dry-etching]
21/31144 . . . . [using masks]
21/3115 . . . . Doping the insulating layers
21/31155 . . . . [by ion implantation]
21/312 . . . . Organic layers, e.g. photoresist (H01L 21/3105, H01L 21/32 take precedence; (photoresists per se G03C))

WARNING

Groups H01L 21/312 – H01L 21/328 are no longer used for the classification of documents as of May 1, 2011. The content of these groups is being reclassified into groups H01L 21/02107 – H01L 21/02326.

Groups H01L 21/02107 – H01L 21/02326 should be considered in order to perform a complete search.

21/3121 . . . . [Layers comprising organo-silicon compounds]
21/3122 . . . . [layers comprising polysiloxane compounds]
21/3124 . . . . [layers comprising hydrogen silsesquioxane]
21/3125 . . . . [layers comprising silazane compounds]
21/3127 . . . . [Layers comprising fluorohydrocarbon compounds, e.g. polytetrafluoroethylene]
21/3128 . . . . [by Langmuir-Blodgett techniques (Frozen) (Frozen) (Frozen) (Frozen) (Frozen)]
WARNING

Groups H01L 21/314 – H01L 21/3185 are no longer used for the classification of documents as of May 1, 2011. The content of these groups is being reclassified into group H01L 21/02107 – H01L 21/02326.

Groups H01L 21/02107 – H01L 21/02326 should be considered in order to perform a complete search.

21/31641 (Frozen) [Deposition of Zirconium oxides, e.g. ZrO₂]
21/31645 (Frozen) [Deposition of Hafnium oxides, e.g. HfO₂]
21/3165 (Frozen) {formed by oxidation (H01L 21/31691, H01L 21/31695 take precedence)}
21/31654 (Frozen) [of semiconductor materials, e.g. the body itself]
21/31658 (Frozen) [by thermal oxidation, e.g. of SiGe]
21/31662 (Frozen) [of silicon in uncombined form]
21/31666 (Frozen) [of AlIII BV compounds]
21/3167 (Frozen) [of anodic oxidation]
21/31675 (Frozen) [of silicon]
21/31679 (Frozen) [of AlIII BV compounds]
21/31683 (Frozen) [of metallic layers, e.g. Al deposited on the body, e.g. formation of multi-layer insulating structures]
21/31687 (Frozen) [by anodic oxidation]
21/31691 (Frozen) [with perovskite structure]
21/31695 (Frozen) {Deposition of porous oxides or porous glassy oxides or oxide based porous glass}
21/318 (Frozen) composed of nitrides

WARNING

Group H01L 21/318 is no longer used for the classification of documents as of May 1, 2011. The content of this group is being reclassified into groups H01L 21/02107 – H01L 21/02326.

Groups H01L 21/02107 – H01L 21/02326 should be considered in order to perform a complete search.

21/3185 (Frozen) {of silicconitrides}
21/32 (Frozen) using masks
21/3205 (Frozen) Deposition of non-insulating-, e.g. conductive- or resistive-, layers on insulating layers; After-treatment of these layers (manufacture of electrodes H01L 21/28)
produce internal imperfections to modify their internal properties, e.g. to make them semi-insulating

Thermal treatment for modifying the properties of semiconductor bodies, e.g. annealing, sintering (H01L 21/20 - H01L 21/288 and H01L 21/302 - H01L 21/322 take precedence)

for the formation of PN junctions without addition of impurities (H01L 21/22 takes precedence)

of A₃B₅ compounds

for altering the shape, e.g. smoothing the surface

WARNING

Group H01L 21/3247 is incomplete pending reclassification of documents from group H01L 21/324.

Groups H01L 21/324 and H01L 21/3247 should be considered in order to perform a complete search.

Application of electric currents or fields, e.g. for electroforming (H01L 21/20 - H01L 21/288 and H01L 21/302 - H01L 21/324 take precedence)

the devices having semiconductor bodies not provided for in groups (H01L 21/0405, H01L 21/0445), H01L 21/06, H01L 21/16 and H01L 21/18 with or without impurities, e.g. doping materials

Diffusion of impurity materials, e.g. doping materials, electrode materials, into or out of a semiconductor body, or between semiconductor regions

using diffusion into or out of a solid from or into a gaseous phase

using diffusion into or out of a solid from or into a solid phase, e.g. a doped oxide layer

using diffusion into or out of a solid from or into a liquid phase, e.g. alloy diffusion processes

Alloying of impurity materials, e.g. doping materials, electrode materials, with a semiconductor body

Bombardment with radiation

with high-energy radiation

producing ion implantation (ion beam tubes for localized treatment H01L 37/30)

using masks

using electromagnetic radiation, e.g. laser radiation

Manufacture of electrodes on semiconductor bodies using processes or apparatus not provided for in groups H01L 21/38 - H01L 21/428

Deposition of conductive or insulating materials for electrodes

from a gas or vapour, e.g. condensation

from a liquid, e.g. electrolytic deposition

involving the application of pressure, e.g. thermo-compression bonding
21/449 . . . . involving the application of mechanical vibrations, e.g. ultrasonic vibrations
21/46 . . . . Treatment of semiconductor bodies using processes or apparatus not provided for in groups H01L 21/428 (manufacture of electrodes thereon H01L 21/44)
21/461 . . . . to change their surface-physical characteristics or shape, e.g. etching, polishing, cutting
21/463 . . . . Mechanical treatment, e.g. grinding, ultrasonic treatment
21/465 . . . . Chemical or electrical treatment, e.g. electrolytic etching (to form insulating layers H01L 21/469)
21/467 . . . . using masks
21/469 . . . . to form insulating layers thereon, e.g. for masking or by using photolithographic techniques (layers forming electrodes H01L 21/44; encapsulating layers H01L 21/46)
21/47 . . . . Organic layers, e.g. photoresist (H01L 21/475, H01L 21/4757 take precedence)
21/471 . . . . Inorganic layers (H01L 21/475, H01L 21/4757 take precedence)
21/473 . . . . composed of oxides or glassy oxides or oxide based glass
21/475 . . . . using masks
21/4757 . . . . After-treatment
21/47573 . . . . [Etching the layer]
21/47576 . . . . [Doping the layer]
21/4763 . . . . Deposition of non-insulating, e.g. conductive-, resistive-, layers on insulating layers; After-treatment of these layers (manufacture of electrodes H01L 21/28, H01L 21/44)
21/47635 . . . . [After-treatment of these layers]
21/477 . . . . Thermal treatment for modifying the properties of semiconductor bodies, e.g. annealing, sintering (H01L 21/38 - H01L 21/449 and H01L 21/461 - H01L 21/475 take precedence)
21/479 . . . . Application of electric currents or fields, e.g. for electroforming (H01L 21/38 - H01L 21/449 and H01L 21/461 - H01L 21/475 take precedence)
21/48 . . . . 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 H01L 21/06 - H01L 21/326 (apparatus therefor H01L 21/67005; insulative sealing of leads in bases H01L 21/50); containers, encapsulations, fillings, mountings per se H01L 23/00; (marking of parts H01L 23/544)

**NOTE:**
In this group, the expression "treatment" covers also the removal of leads from parts

21/4803 . . . . [Insulating or insulated parts, e.g. mountings, containers, diamond heatsinks (H01L 21/4846 takes precedence; printed circuit boards H05K 1/00)]
21/4807 . . . . [Ceramic parts]
21/481 . . . . Insulating layers on insulating parts, with or without metallisation
21/4814 . . . . [Conductive parts]
21/4817 . . . . [for containers, e.g. caps (H01L 21/4871 takes precedence)]
21/4821 . . . . [Flat leads, e.g. lead frames with or without insulating supports]
21/4825 . . . . [Connection or disconnection of other leads to or from flat leads, e.g. wires, bumps, other flat leads]
21/4828 . . . . [Etching (etching for cleaning without patterning H01L 21/4835)]
21/4832 . . . . [Etching a temporary substrate after encapsulation process to form leads]
21/4835 . . . . [Cleaning, e.g. removing of solder]
21/4839 . . . . [Assembly of a flat lead with an insulating support, e.g. for TAB]
21/4842 . . . . [Mechanical treatment, e.g. punching, cutting, deforming, cold welding]
21/4846 . . . . [Leads on or in insulating or insulated substrates, e.g. metallisation (H01L 21/4821 takes precedence; metallisation of ceramics in general C04B 41/51; printed circuits H05K 3/00)]
21/485 . . . . [Adaptation of interconnections, e.g. engineering charges, repair techniques]
21/4853 . . . . [Connection or disconnection of other leads to or from a metallisation, e.g. pins, wires, bumps]
21/4857 . . . . [Multilayer substrates (multilayer metallisation on monolayer substrate H01L 21/4846)]
21/486 . . . . [Via connections through the substrate with or without pins]
21/4864 . . . . [Cleaning, e.g. removing of solder]
21/4867 . . . . [Applying pastes or inks, e.g. screen printing (H01L 21/486 takes precedence)]
21/4871 . . . . [Bases, plates or heatsinks]
21/4875 . . . . [Connection or disconnection of other leads to or from bases or plates]
21/4878 . . . . [Mechanical treatment, e.g. deforming]
21/4882 . . . . [Assembly of heatsink parts]
21/4885 . . . . [Wire-like parts or pins (wire ball formation B23K 20/00; methods related to connecting semiconductor or other solid state bodies H01L 24/00)]
21/4889 . . . . [Connection or disconnection of other leads to or from wire-like parts, e.g. wires]
21/4892 . . . . [Cleaning]
21/4896 . . . . [Mechanical treatment, e.g. cutting, bending]
21/50 . . . . . . Assembly of semiconductor devices using processes or apparatus not provided for in a single one of the subgroups H01L 21/06 - H01L 21/326, e.g. sealing of a cap to a base of a container

**NOTE**

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 H01L 24/00

21/52 . . . . . . Mounting semiconductor bodies in containers

21/54 . . . . . . Providing fillings in containers, e.g. gas fillings

21/56 . . . . . . Encapsulations, e.g. encapsulation layers, coatings

21/561 . . . . . . (Batch processing)

21/563 . . . . . . (Encapsulation of active face of flip-chip device, e.g. underfilling or underencapsulation of flip-chip, encapsulation preform on chip or mounting substrate)

21/565 . . . . . . (Moulds)

21/566 . . . . . . (Release layers for moulds, e.g. release layers, layers against residue during moulding)

21/568 . . . . . . (Temporary substrate used as encapsulation process aid (H01L 21/4832 and H01L 21/566 take precedence))

2021/60 . . . . . . [Attaching or detaching leads or other conductive members, to be used for carrying current to or from the device in operation]

2021/60007 . . . . . . [involving a soldering or an alloying process]

2021/60015 . . . . . . [using plate connectors, e.g. layer, film]

2021/60022 . . . . . . [using bump connectors, e.g. for flip chip mounting]

2021/6003 . . . . . . [Apparatus therefor]

2021/60037 . . . . . . [Right-up bonding]

2021/60045 . . . . . . [Pre-treatment step of the bump connectors prior to bonding]

2021/60052 . . . . . . [Oxide removing step, e.g. flux, rosin]

2021/6006 . . . . . . [with temporary supporting member not part of an apparatus, e.g. removable coating, film or substrate]

2021/60067 . . . . . . [Aligning the bump connectors with the mounting substrate]

2021/60075 . . . . . . [involving active alignment, i.e. by apparatus steering, e.g. using alignment marks, sensors]

2021/60082 . . . . . . [involving passive alignment, e.g. using surface energy, chemical reactions, thermal equilibrium]

2021/6009 . . . . . . [involving guiding structures, e.g. structures that are left at least partly in the bonded product, spacers]

2021/60097 . . . . . . [Applying energy, e.g. for the soldering or alloying process]

2021/60105 . . . . . . [using electromagnetic radiation]

2021/60112 . . . . . . [Coherent radiation, i.e. laser beam]

2021/6012 . . . . . . [Incoherent radiation, e.g. polychromatic heating lamp]

2021/60127 . . . . . . [Induction heating, i.e. eddy currents]

2021/60135 . . . . . . [using convection, e.g. eddy currents]

2021/60142 . . . . . . [with a graded temperature profile]

2021/6015 . . . . . . [using conduction, e.g. chuck heater, thermocompression]

2021/60157 . . . . . . [with a graded temperature profile]

2021/60165 . . . . . . [using an electron beam]

2021/60172 . . . . . . [using static pressure]

2021/6018 . . . . . . [Unidirectional static pressure]

2021/60187 . . . . . . [Isostatic pressure, e.g. degassing using vacuum or pressurised liquid]

2021/60195 . . . . . . [using dynamic pressure, e.g. ultrasonic or thermosonic bonding]

2021/60202 . . . . . . [using a protective atmosphere, e.g. with forming or shielding gas]

2021/6021 . . . . . . [using an autocatalytic reaction]

2021/60217 . . . . . . [Detaching bump connectors, e.g. after testing]

2021/60225 . . . . . . [Arrangement of bump connectors prior to mounting]

2021/60232 . . . . . . [wherein the bump connectors are disposed only on the semiconductor chip]

2021/6024 . . . . . . [wherein the bump connectors are disposed only on the mounting substrate]

2021/60247 . . . . . . [wherein the bump connectors are disposed on both the semiconductor chip and the mounting substrate, e.g. bump to bump]

2021/60255 . . . . . . [wherein the bump connectors are provided as prepeg, e.g. are provided in an insulating plate member]

2021/60262 . . . . . . [Lateral distribution of bump connectors prior to mounting]

2021/6027 . . . . . . [Mounting on semiconductor conductive members]

2021/60277 . . . . . . [involving the use of conductive adhesives]

2021/60285 . . . . . . [involving the use of mechanical auxiliary parts without the use of an alloying of soldering process, e.g. pressure contacts]

2021/60292 . . . . . . [involving the use of an electron or laser beam]

2021/603 . . . . . . [involving the application of pressure, e.g. thermo-compression bonding]

2021/607 . . . . . . [involving the application of mechanical vibrations, e.g. ultrasonic vibrations]

21/62 . . . . . . the devices having no potential-jump barriers or surface barriers

21/64 . . . . . . 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 H01L 31/00 - H01L 51/00
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 [: Apparatus not specifically provided for elsewhere (processes per se H01L 21/30; H01L 21/46, H01L 23/00; simple temporary support means, e.g. using adhesives, electric or magnetic means H01L 21/68, H01L 21/302; apparatus for manufacturing arrangements for connecting or disconnecting semiconductor or solid-state bodies and for methods related thereto H01L 24/74:)]

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

[Apparatus not specifically provided for elsewhere (processes per se H01L 21/30; H01L 21/46, H01L 23/00; simple temporary support means, e.g. using adhesives, electric or magnetic means H01L 21/68, H01L 21/302)]

[Apparatus for manufacture or treatment (processes H01L 21/30, H01L 21/46; for production or after-treatment of single crystals or homogeneous polycrystalline material C30B 35/00)]

[Apparatus for fluid treatment (H01L 21/67126, H01L 21/6715 take precedence)]

{for general liquid treatment, e.g. etching followed by cleaning}

{for cleaning followed by drying, rinsing, stripping, blasting or the like}

{for drying}

{for wet cleaning or washing}

{using mainly scrubbing means, e.g. brushes}

{using mainly spraying means, e.g. nozzles}

{with the semiconductor substrates being dipped in baths or vessels}

{for etching}

{for drying etching}

{for wet etching}

{using mainly spraying means, e.g. nozzles}

{with the semiconductor substrates being dipped in baths or vessels}

{Apparatus for mechanical treatment (or grinding or cutting, see the relevant groups in subclasses B24B or B28D)}

{Apparatus for thermal treatment}

{mainly by conduction}

{mainly by convection}

{mainly by radiation}

{Apparatus for making assemblies not otherwise provided for, e.g. package constructions}

{Apparatus for sealing, encapsulating, glassing, decapsulating or the like (processes H01L 23/02, H01L 23/28)}

[Apparatus for placing on an insulating substrate, e.g. tape]

[Apparatus for wiring semiconductor or solid state device]

[Apparatus for mounting on conductive members, e.g. leadframes or conductors on insulating substrates]

[Apparatus for applying a liquid, a resin, an ink or the like (H01L 21/67126 takes precedence)]

[Apparatus for manufacturing or treating in a plurality of work-stations]

[characterized by the layout of the process chambers]

{surrounding a central transfer chamber}

{in-line arrangement}

{vertical arrangement}

{characterized by the presence of more than one transfer chamber}

{characterized by the construction of the processing chambers, e.g. modular processing chambers}

{characterized by the construction of the transfer chamber}

{characterized by the construction of the load-lock chamber}

{comprising a chamber adapted to a particular process}

{comprising at least one ion or electron beam chamber (coating by ion implantation C23C; ion or electron beam tubes H01J 37/00)}

{comprising at least one polishing chamber (polishing apparatuses B24B)}

{comprising at least one lithography chamber (lithographic apparatuses G03F 7/00)}

{comprising at least one plating chamber (electroless plating apparatuses C23C, electroplating apparatuses C25D)}

{the substrates being processed being not semiconductor wafers, e.g. leadframes or chips}

{Apparatus for monitoring, sorting or marking (testing or measuring during manufacture H01L 22/00, marks per se H01L 23/544; testing individual semiconductor devices G01R 31/26)}

{Temperature monitoring}

{Process monitoring, e.g. flow or thickness monitoring}

{Position monitoring, e.g. misposition detection or presence detection}

{of substrates stored in a container, a magazine, a carrier, a boat or the like}

{Sorting devices}

{Production flow monitoring, e.g. for increasing throughput (program-control systems per se G05B 19/00, e.g. total factory control G05B 19/418)}

{Marking devices}
using specially adapted carriers (or holders; fixing the workpieces on such carriers or holders (holders for supporting a complete device in operation H01L 23/32))

(characterized by being specially adapted for supporting a complete device in operation H01L 23/32)

[Vertical type carrier whereby the substrates are horizontally supported, e.g. comprising rod-shaped elements]

(characterized by a material, a roughness, a coating or the like)

[Horizontal type carrier whereby the substrates are vertically supported, e.g. comprising rod-shaped elements]

(characterized by a material, a roughness, a coating or the like)

[Horizontal carrier comprising wall type elements whereby the substrates are vertically supported, e.g. comprising sidewalls]

(characterized by a material, a roughness, a coating or the like)

[Vertical carrier comprising wall type elements whereby the substrates are horizontally supported, e.g. comprising sidewalls]

(characterized by a material, a roughness, a coating or the like)

{Trays for chips (magazine for components H05K 13/0084)}

(characterized by a material, a roughness, a coating or the like)

{specially adapted for supporting large square shaped substrates (containers and packaging elements for glass sheets B65D 85/48, transporting of glass products during their manufacture C03B 35/00)}

(characterized by a material, a roughness, a coating or the like)

[Closed carriers]

[specially adapted for a single substrate]

[specially adapted for containing chips, dies or ICs]

[specially adapted for containing masks, reticles or pellicles]

[specially adapted for containing substrates other than wafers (H01L 21/67356, H01L 21/67359 take precedence)]

(characterised by materials, roughness, coatings or the like (materials relating to an injection moulding process B29C 45/00; chemical composition of materials C08L 51/00))

(characterised by shock absorbing elements, e.g. retainers or cushions)

[characterised by locking systems]

[characterised by sealing arrangements]

[characterised by coupling elements, kinematic members, handles or elements to be externally gripped]

{Closed carriers}

{specially adapted for a single substrate}

[specially adapted for containing chips, dies or ICs]

[characterised by substrate supports]

[characterised by the construction of the closed carrier]

[characterised by atmosphere control]

[characterised by the presence of atmosphere modifying elements inside or attached to the closed carrier]

[characterised by the presence of antistatic elements]

[mechanical parts of transfer devices (robots in general in B25J)]

[mechanical parts of transfer devices (robots in general in B25J)]

[characterised by movements or sequence of movements of transfer devices]

[horizontal transfer of a single workpiece]

[vertical transfer of a single workpiece]

[horizontal transfer of a batch of workpieces]

[vertical transfer of a batch of workpieces]

[continuous loading and unloading into and out of a processing chamber, e.g. transporting belts within processing chambers]

[the wafers being stored in a carrier, involving loading and unloading (H01L 21/6779 takes precedence)]

[mechanical parts of transfer devices (robots in general in B25J)]

[storage means]

[involving removal of lid, door, cover]

[docking arrangements]

[involving loading and unloading of wafers]

[batch transfer of wafers]

[using air tracks]

[with angular orientation of the workpieces]

[the workpieces being stored in a carrier, involving loading and unloading]

[with orientating and positioning by means of a vibratory bowl or track]
21/67796 . . . [with angular orientation of workpieces (H01L 21/67787 and H01L 21/67793 take precedence)]

21/68 . . . for positioning, orientation or alignment (for conveying H01L 21/677)

21/681 . . . [using optical controlling means]

21/682 . . . [Mask-wafer alignment (in general G03F 7/70, G03F 9/70)]

21/683 . . . for supporting or gripping (for conveying H01L 21/677, for positioning, orientation or alignment H01L 21/68)

21/6831 . . . [using electrostatic chucks]

21/6833 . . . [Details of electrostatic chucks]

21/6835 . . . [using temporarily an auxiliary support]

**NOTE**

H01L 21/6835. details of the apparatus are to be further indexed using the indexing codes chosen from H01L 2221/68304 and subgroups

21/6836 . . . [Wafer tapes, e.g. grinding or dicing support tapes (adhesive tapes in general C09J 7/20)]

21/6838 . . . [with gripping and holding devices using a vacuum; Bernoulli devices]

21/687 . . . using mechanical means, e.g. chucks, clamps or pinches [using electrostatic chucks H01L 21/6831]

21/68707 . . . [the wafers being placed on a robot blade, or gripped by a gripper for conveyance]

21/68714 . . . [the wafers being placed on a susceptor, stage or support]

21/68721 . . . [characterised by edge clamping, e.g. clamping ring]

21/68728 . . . [characterised by a plurality of separate clamping members, e.g. clamping fingers]

21/68735 . . . [characterised by edge profile or support profile]

21/68742 . . . [characterised by a lifting arrangement, e.g. lift pins]

21/6875 . . . [characterised by a plurality of individual support members, e.g. support posts or protrusions]

21/68757 . . . [characterised by a coating or a hardness or a material]

21/68764 . . . [characterised by a movable susceptor, stage or support, others than those only rotating on their own vertical axis, e.g. susceptors on a rotating carrousel]

21/68771 . . . [characterised by supporting more than one semiconductor substrate]

21/68778 . . . [characterised by supporting substrates others than wafers, e.g. chips]

21/68785 . . . [characterised by the mechanical construction of the susceptor, stage or support]

21/68792 . . . [characterised by the construction of the shaft]

21/70 . . . 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 ([multistep manufacturing processes of assemblies consisting of a plurality of individual semiconductor or other solid state devices H01L 25/00;] manufacture of assemblies consisting of preformed electrical components H05K 3/00, H05K 13/00)

21/702 . . . [of thick-or thin-film circuits or parts thereof]

21/705 . . . [of thick-film circuits or parts thereof]

21/707 . . . [of thin-film circuits or parts thereof]

21/71 . . . Manufacture of specific parts of devices defined in group H01L 21/70 ([H01L 21/0405, H01L 21/0445, H01L 21/28, H01L 21/44, H01L 21/48 take precedence)]

21/74 . . . Making of [localized] buried regions, e.g. buried collector layers, internal connections [substrate contacts]

21/743 . . . [Making of internal connections, substrate contacts]

21/746 . . . [for All-BV integrated circuits]

21/76 . . . Making of isolation regions between components

21/7602 . . . [between components manufactured in an active substrate comprising SiC compounds]

21/7605 . . . [between components manufactured in an active substrate comprising AIII BV compounds]

21/7607 . . . [between components manufactured in an active substrate comprising AII BV compounds]

21/761 . . . [PN junctions]

21/762 . . . Dielectric regions [, e.g. EPIC dielectric isolation, LOCOS; Trench refilling techniques, SOI technology, use of channel stoppers]

21/76202 . . . [using a local oxidation of silicon, e.g. LOCOS, SWAMI, SILO (H01L 21/76235 takes precedence; together with vertical isolation, e.g. LOCOS in a SOI substrate, H01L 21/76264)]

21/76205 . . . [in a region being recessed from the surface, e.g. in a recess, groove, tub or trench region]

21/76208 . . . [using auxiliary pillars in the recessed region, e.g. to form LOCOS over extended areas]

21/7621 . . . [the recessed region having a shape other than rectangular, e.g. rounded or oblique shape (H01L 21/76208 takes precedence)]

21/76213 . . . [introducing electrical inactive or active impurities in the local oxidation region, e.g. to alter LOCOS oxide growth characteristics or for additional isolation purpose]

21/76216 . . . [introducing electrical active impurities in the local oxidation region for the sole purpose of creating channel stoppers]
[Introducing both types of electrical active impurities in the local oxidation region for the sole purpose of creating channel stops, e.g. for isolation of complementary doped regions]

{with a plurality of successive local oxidation steps}

{using trench refilling with dielectric materials (trench filling with polycrystalline silicon H01L 21/763; together with vertical isolation, e.g. trench refilling in a SOI substrate H01L 21/76264)}

{the dielectric materials being obtained by full chemical transformation of non-dielectric materials, such as polycrystalline silicon, metals}

{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}

{of trenches having a shape other than rectangular or V-shape, e.g. rounded corners, oblique or rounded trench walls (H01L 21/76229 takes precedence)}

{trench shape altered by a local oxidation of silicon process step, e.g. trench corner rounding by LOCOS}

{introducing impurities in trench side or bottom walls, e.g. for forming channel stoppers or alter isolation behavior}

{using semiconductor on insulator [SOI] technology (H01L 21/76297 takes precedence; manufacture of integrated circuits on insulating substrates H01L 21/84; silicon on sapphire [SOS] technology H01L 21/86)}

{using silicon implanted buried insulating layers, e.g. oxide layers, i.e. SIMOX techniques}

{using full isolation by porous oxide silicon, i.e. FIPOS techniques}

{using lateral overgrowth techniques, i.e. ELO techniques}

{using bonding techniques}

{with separation/delamination along an ion implanted layer, e.g. Smart-cut, Unibond}

{using silicon etch back techniques, e.g. BESOI, ELTRAN}

{with separation/delamination along a porous layer}

{using selective deposition of single crystal silicon, i.e. SEG techniques}

{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}

{Vertical isolation by silicon implanted buried insulating layers, e.g. oxide layers, i.e. SIMOX techniques}

{Vertical isolation by full isolation by porous oxide silicon, i.e. FIPOS techniques}

{Vertical isolation by lateral overgrowth techniques, i.e. ELO techniques}

{Vertical isolation by bonding techniques}

{Vertical isolation by selective deposition of single crystal silicon, i.e. SEG techniques}

{Vertical isolation by selective oxidation of silicon}

{Vertical isolation by refilling of trenches with dielectric material}

{Vertical isolation by refilling of trenches with polycrystalline material}

{Vertical isolation by air gap}

{Vertical isolation by field effect}

{using selective deposition of single crystal silicon, i.e. SEG techniques}

{Dielectric isolation using EPIC techniques, i.e. epitaxial passivated integrated circuit}

{Polycrystalline semiconductor regions (H01L 21/7664 takes precedence)}

{Air gaps (H01L 21/7664 takes precedence)}

{by field effect (H01L 21/7664 takes precedence)}

{Applying interconnections to be used for carrying current between separate components within a device (comprising conductors and dielectrics)}

**NOTE**

Groups

H01L 21/768 - H01L 21/76898 cover multi-step processes for manufacturing interconnections. Information peculiar to single-step processes should also be classified in the corresponding group, e.g.

- cleaning H01L 21/02041
- etching H01L 21/311, H01L 21/3213
- masking H01L 21/027, H01L 21/033, H01L 21/3144, H01L 21/32139
- planarizing H01L 21/3105, H01L 21/321

{characterised by the formation and the after-treatment of the dielectrics, e.g. smoothing)

{by forming openings in dielectrics}

{by forming tapered via holes}

{for dual damascene structures}

{involving intermediate temporary filling with material}

{involving one or more buried masks}

{involving multiple stacked pre-patterned masks}

{involving a partial via etch}
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. H01L 21/28026

21/7684 . . . . . {Smoothing; Planarisation}
21/76841 . . . . . {Barrier, adhesion or liner layers}
21/76843 . . . . . {formed in openings in a dielectric}
21/76844 . . . . . {Bottomless liners}
21/76846 . . . . . {Layer combinations}
21/76847 . . . . . {the layer being positioned within the main fill metal}
21/76849 . . . . . {the layer being positioned on top of the main fill metal}
21/76888 . . . . . . [By rendering at least a portion of the conductor non conductive, e.g. oxidation]
21/76889 . . . . . . [by forming silicides of refractory metals]
21/76891 . . . . . . [by using superconducting materials]
21/76892 . . . . . . [modifying the pattern]
21/76894 . . . . . . [using a laser, e.g. laser cutting, laser direct writing, laser repair]
21/76895 . . . . . . [Local interconnects; Local pads, as exemplified by patent document EP0896365]
21/76897 . . . . . . [Formation of self-aligned vias or contact plugs, i.e. involving a lithographically uncritical step (self-aligned silicidation on field effect transistors H01L 29/665)]
21/76898 . . . . . . [formed through a semiconductor substrate]
21/77 . . . . . . Manufacture or treatment of devices consisting of a plurality of solid state components or integrated circuits formed in, or on, a common substrate (electrically programmable read-only memories or multistep manufacturing processes therefor H01L 27/115)

**NOTE**
Integration processes for the manufacture of devices of the type classified in H01L 27/14 - H01L 27/32 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 H01L 27/1052; Multistep processes for manufacturing dynamic random access memory structures are covered by H01L 27/10844; Multistep processes for manufacturing static random access memory structures are covered by H01L 27/11; Multistep processes for manufacturing read-only memory structures are covered by H01L 27/112; Multistep processes for manufacturing electrically programmable read-only memory structures are covered by H01L 27/115

2021/775 . . . . . . [comprising a plurality of TFTs on a non-semiconducting substrate, e.g. driving circuits for AMLCDs]
21/78 . . . . . . with subsequent division of the substrate into plural individual devices (cutting to change the surface-physical characteristics or shape of semiconductor bodies H01L 21/304)
21/7806 . . . . . . [involving the separation of the active layers from a substrate]
21/7813 . . . . . . [leaving a reusable substrate, e.g. epitaxial lift off]
21/782 . . . . . . to produce devices, each consisting of a single circuit element (H01L 21/82 takes precedence)
21/784 . . . . . . the substrate being a semiconductor body
21/786 . . . . . . the substrate being other than a semiconductor body, e.g. insulating body
21/82 . . . . . . to produce devices, e.g. integrated circuits, each consisting of a plurality of components

21/8206 . . . . . . [the substrate being a semiconductor, using diamond technology (H01L 21/8258 takes precedence)]
21/8213 . . . . . . [the substrate being a semiconductor, using SiC technology (H01L 21/8258 takes precedence)]
21/822 . . . . . . the substrate being a semiconductor, using silicon technology (H01L 21/8258 takes precedence)
21/8221 . . . . . . [Three dimensional integrated circuits stacked in different levels]
21/8222 . . . . . . Bipolar technology
21/8224 . . . . . . comprising a combination of vertical and lateral transistors
21/8226 . . . . . . comprising merged transistor logic or integrated injection logic
21/8228 . . . . . . Complementary devices, e.g. complementary transistors
21/82285 . . . . . . (Complementary vertical transistors)
21/8229 . . . . . . Memory structures
21/8232 . . . . . . Field-effect technology
21/8234 . . . . . . MIS technology, i.e. integration processes of field effect transistors of the conductor-insulator-semiconductor type
21/823406 . . . . . . [Combination of charge coupled devices, i.e. CCD, or BBD]
21/823412 . . . . . . [with a particular manufacturing method of the channel structures, e.g. channel implants, halo or pocket implants, or channel materials]
21/823418 . . . . . . [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]
21/823425 . . . . . . [manufacturing common source or drain regions between a plurality of conductor-insulator-semiconductor structures]
21/823431 . . . . . . [with a particular manufacturing method of transistors with a horizontal current flow in a vertical sidewall of a semiconductor body, e.g. FinFET, MuGFET]
21/823437 . . . . . . [with a particular manufacturing method of the gate conductors, e.g. particular materials, shapes]
21/823443 . . . . . . [silicided or salicided gate conductors]
21/82345 . . . . . . [gate conductors with different gate conductor materials or different gate conductor implants, e.g. dual gate structures]
21/823456 . . . . . . [gate conductors with different shapes, lengths or dimensions]
transistors, e.g. CMOS
Complementary field-effect depletion transistors
Combination of enhancement and depletion transistors
Complementary field-effect transistors, e.g. CMOS
Combination of bipolar and field-effect technology
Bipolar and MOS technology
the substrate being a semiconductor, using III-V technology (H01L 21/8258 takes precedence)
the substrate being a semiconductor, using II-VI technology (H01L 21/8258 takes precedence)
the substrate being a semiconductor, using technologies not covered by one of groups (H01L 21/8206, H01L 21/8212)
the substrate being a semiconductor, using a combination of technologies covered by (H01L 21/8206, H01L 21/8212), H01L 21/822, H01L 21/8252 and H01L 21/8254 (H01L 21/8258 takes precedence)
the substrate being a semiconductor, using an insulating body
including field-effect transistors with a horizontal current flow in a vertical sidewall of a semiconductor body, e.g. FinFET, MuGFET
the insulating body being sapphire, e.g. silicon on sapphire structure, i.e. SOS

(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)
22/10 . . . (Measuring as part of the manufacturing process (burn-in G01R 31/2855))

22/12 . . . (for structural parameters, e.g. thickness, line width, refractive index, temperature, warp, bond strength, defects, optical inspection, electrical measurement of structural dimensions, metallurgical measurement of diffusions (electrical measurement of diffusions H01L 22/14))

22/14 . . . (for electrical parameters, e.g. resistance, deep-levels, CV, diffusions by electrical means)

22/20 . . . (Sequence of activities consisting of a plurality of measurements, corrections, marking or sorting steps)

22/22 . . . (Connection or disconnection of sub-units or redundant parts of a device in response to a measurement (testing and repair of stores after manufacture including at wafer scale G11C 29/00; fuses per se H01L 23/32))

22/24 . . . (Optical enhancement of defects or not directly visible states, e.g. selective electrolytic deposition, bubbles in liquids, light emission, colour change (voltage contrast G01R 31/311))

22/26 . . . (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 B24B 37/013, in discharge apparatus H01J 37/32))

22/30 . . . (Structural arrangements specially adapted for testing or measuring during manufacture or treatment, or specially adapted for reliability measurements)

22/32 . . . (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 H01L 23/48))

22/34 . . . (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, gates, metal layers having an insulating base, e.g. G01R 31/2855; process control with lithography, e.g. dose control, G03F 7/20; structures for alignment control by optical means G03F 7/70633))

23/00 Details of semiconductor or other solid state devices (H01L 25/00 takes precedence (; structural arrangements for testing or measuring during manufacture or treatment, or for reliability measurements H01L 22/00; arrangements for connecting or disconnecting semiconductor or solid-state bodies, or methods related thereto H01L 24/00; finger print sensors G06K 9/00006))

NOTE
This group does not cover:
• details of semiconductor bodies or of electrodes of devices provided for in group H01L 29/00, which details are covered by that group;
• details peculiar to devices provided for in a single main group of groups

H01L

23/02 . . . Containers; Seals (H01L 23/12, H01L 23/34, H01L 23/48, H01L 23/522, H01L 23/66) take precedence; (for memories G11C)

23/04 . . . characterised by the shape [of the container or parts, e.g. caps, walls]

23/041 . . . (the container being a hollow construction having no base used as a mounting for the semiconductor body)

23/043 . . . the container being a hollow construction and having a conductive base as a mounting as well as a lead for the semiconductor body

23/045 . . . the other leads having an insulating passage through the base

23/047 . . . the other leads being parallel to the base

23/049 . . . the other leads being perpendicular to the base

23/051 . . . another lead being formed by a cover plate parallel to the base plate, e.g. sandwich type

23/053 . . . the container being a hollow construction and having an insulating [or insulated] base as a mounting for the semiconductor body

23/055 . . . the leads having a passage through the base

23/057 . . . the leads being parallel to the base

23/06 . . . characterised by the material of the container or its electrical properties

23/08 . . . the material being an electrical insulator, e.g. glass

23/10 . . . characterised by the material or arrangement of seals between parts, e.g. between cap and base of the container or between leads and walls of the container

23/12 . . . Mountings, e.g. non-detachable insulating substrates

23/13 . . . characterised by the shape

23/14 . . . characterised by the material or its electrical properties [{printed circuit boards H05K 1/00}]

23/142 . . . [Metallic substrates having insulating layers]

23/145 . . . [Organic substrates, e.g. plastic]

23/147 . . . [Semiconductor insulating substrates (semiconductor conductive substrates H01L 23/4926)]

23/15 . . . Ceramic or glass substrates [{H01L 23/142, H01L 23/145, H01L 23/147 take precedence}]

23/16 . . . Fillings or auxiliary members in containers {or encapsulations}, e.g. centering rings (H01L 23/42, H01L 23/522 take precedence)

23/18 . . . Fillings characterised by the material, its physical or chemical properties, or its arrangement within the complete device

NOTE
Group H01L 23/26 takes precedence over groups H01L 23/20 - H01L 23/24

23/20 . . . gaseous at the normal operating temperature of the device

23/22 . . . liquid at the normal operating temperature of the device

23/24 . . . solid or gel at the normal operating temperature of the device [H01L 23/3135 takes precedence]
23/26 . . . including materials for absorbing or reacting with moisture or other undesired substances [e.g. getters].

23/28 . Encapsulations, e.g. encapsulating layers, coatings, [e.g. for protection] \((H01L 23/352)\) takes precedence; [insulating layers for contacts or interconnections \((H01L 23/5329)\)].

23/29 . . . characterised by the material [e.g. carbon (interlayer dielectrics \((H01L 23/5329)\)].

23/291 . . . {Oxides or nitrates or carbides, e.g. ceramics, glass}.

23/293 . . . {Organic, e.g. plastic}.

23/295 . . . {containing a filler \((H01L 23/296)\) takes precedence}.

23/296 . . . {Organo-silicon compounds}.

23/298 . . . {Semiconductor material, e.g. amorphous silicon}.

23/31 . . . characterised by the arrangement [or shape].

23/3107 . . . {the device being completely enclosed}.

23/3114 . . . {the device being a chip scale package, e.g. CSP}.

23/3121 . . . {a substrate forming part of the encapsulation}.

23/3128 . . . {the substrate having spherical bumps for external connection}.

23/3135 . . . {Double encapsulation or coating and encapsulation}.

23/3142 . . . {Sealing arrangements between parts, e.g. adhesion promoters}.

23/315 . . . {the encapsulation having a cavity}.

23/3157 . . . {Partial encapsulation or coating (mask layer used as insulation layer \((H01L 21/31)\)}.

23/3164 . . . {the coating being a foil}.

23/3171 . . . {the coating being directly applied to the semiconductor body, e.g. passivation layer \((H01L 23/3178)\) takes precedence}.

23/3178 . . . {Coating or filling in grooves made in the semiconductor body}.

23/3185 . . . {the coating covering also the sidewalls of the semiconductor body}.

23/3192 . . . {Multilayer coating}.

23/32 . . . Holders for supporting the complete device in operation, i.e. detachable fixtures \((H01L 23/40)\) takes precedence; connectors, [e.g. sockets], in general \((H01L 21/00)\). primed for printed circuits \((H01K 65K)\).

23/34 . . . Arrangements for cooling, heating, ventilating or temperature compensation [Temperature sensing arrangements \((thermal treatment apparatus \((H01L 21/00)\)\)].

23/345 . . . {Arrangements for heating \((thermal treatment apparatus \((H01L 21/00)\)\)}.

23/36 . . . Selection of materials, or shaping, to facilitate cooling or heating, e.g. heatsinks \((H01L 23/38, H01L 23/40, H01L 23/42, H01L 23/44, H01L 23/46 take precedence; heating \((H01L 23/345)\)}.

23/367 . . . Cooling facilitated by shape of device \((H01L 23/38, H01L 23/40, H01L 23/42, H01L 23/44, H01L 23/46 take precedence)}.

23/3672 . . . {Foil-like cooling fins or heat sinks (being part of lead-frames \((H01L 23/49568)\)}.

23/3675 . . . {characterised by the shape of the housing}.

23/3677 . . . {Wire-like or pin-like cooling fins or heat sinks}.

23/373 . . . Cooling facilitated by selection of materials for the device [or materials for thermal expansion adaptation, e.g. carbon] (H01L 23/3732, H01L 23/3733, H01L 23/3735, H01L 23/3737, H01L 23/3738 take precedence)}.

23/3732 . . . {Diamonds}.

23/3733 . . . {having a heterogeneous or anisotropic structure, e.g. powder or fibres in a matrix, wire mesh, porous structures \((H01L 23/3732, H01L 23/3737\) takes precedence)\).

23/3735 . . . {Laminates or multilayers, e.g. direct bond copper ceramic substrates}.

23/3736 . . . {Metallic materials \((H01L 23/3732, H01L 23/3733, H01L 23/3735, H01L 23/3737, H01L 23/3738\) take precedence)\).

23/3737 . . . {Organic materials with or without a thermoconductive filler}.

23/3738 . . . {Semiconductor materials}.

23/38 . . . Cooling arrangements using the Peltier effect.

23/40 . . . Mountings or securing means for detachable cooling or heating arrangements \((heating \((H01L 23/345)\)\) fixed by friction, plugs or springs) \((H01L 23/40)\). with bolts or screws) \((H01L 23/40)\).

23/4006 . . . {for stacked arrangements of a plurality of semiconductor devices \((assemblies per se \((H01L 23/40)\)\).}

23/4012 . . . {characterised by the type of device to be heated or cooled}.

2023/4018 . . . \((H01L 23/40)\). [characterised by the type of device to be heated or cooled].

2023/4025 . . . \((H01L 23/40)\). Base discrete devices, e.g. presspack, disc-type transistors.

2023/4031 . . . \((H01L 23/40)\). Packaged discrete devices, e.g. to-3 housings, diodes.

2023/4037 . . . \((H01L 23/40)\). characterised by thermal path or place of attachment of heatsink.

2023/4043 . . . \((H01L 23/40)\). heatsink to have chip.

2023/405 . . . \((H01L 23/40)\). heatsink to package.

2023/4056 . . . \((H01L 23/40)\). heatsink to additional heatsink.

2023/4062 . . . \((H01L 23/40)\). heatsink to or through board or cabinet.

2023/4068 . . . \((H01L 23/40)\). Heatconductors between device and heatsink, e.g. compliant heat-spreaders, heat-conducting bands.

2023/4075 . . . \((H01L 23/40)\). [Mechanical elements].

2023/4081 . . . \((H01L 23/40)\). Compliant clamping elements not primarily serving heat-conduction.

2023/4087 . . . \((H01L 23/40)\). Mounting accessories, interposers, clamping or screwing parts.

23/4093 . . . \((H01L 23/40)\). Snap-on arrangements, e.g. clips.

23/42 . . . Fillings or auxiliary members in containers [or encapsulations] selected or arranged to facilitate heating or cooling \((heating \((H01L 23/345)\)\). characterised by selection of materials for the device \((H01L 23/3737)\).]

23/427 . . . Cooling by change of state, e.g. use of heat pipes [by liquefied gas \((H01L 23/445)\).]

23/4275 . . . \((H01L 23/445)\). [by melting or evaporation of solids].

23/433 . . . \((H01L 23/445)\). Auxiliary members [in containers] characterised by their shape, e.g. pistons.

23/4332 . . . \((H01L 23/445)\). Bellowes.

23/4334 . . . \((H01L 23/445)\). Auxiliary members in encapsulations \((H01L 23/49568)\) takes precedence).

23/4336 . . . \((H01L 23/49568)\) takes precedence).
Arrangements for conducting electric current to or from the solid state body in operation, e.g. leads, terminal arrangements (in general H01R); {Selection of materials therefor}

NOTE
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 H01L 24/00

23/481 . . . . . . {Internal lead connections, e.g. via connections, feedthrough structures}  
23/482 . . . . . . consisting of lead-in layers inseparably applied to the semiconductor body {electrodes H01L 29/40}  
23/4821 . . . . . . {Bridge structure with air gap}  
23/4822 . . . . . . {Beam leads}  
23/4824 . . . . . . {Pads with extended contours, e.g. grid structure, branch structure, finger structure}  
23/4825 . . . . . . {for devices consisting of semiconductor layers on insulating or semi-insulating substrates, e.g. silicon on sapphire devices, i.e. SOS}  
23/4827 . . . . . . {Materials}  
23/4828 . . . . . . {Conductive organic material or pastes, e.g. conductive adhesives, inks}  
23/485 . . . . . . consisting of layered constructions comprising conductive layers and insulating layers, e.g. planar contacts {H01L 23/4821, H01L 23/4822, H01L 23/4824, H01L 23/4825 take precedence; materials H01L 23/532, bond pads H01L 24/02, bump connectors H01L 24/10}  
23/4855 . . . . . . {Overhang structure}  
23/488 . . . . . . consisting of soldered (or bonded) constructions {bump connectors H01L 24/01}  
23/49 . . . . . . wire-like {arrangements or pins or rods (using optical fibres H01L 23/48; pins attached to insulating substrates H01L 23/49811)}  
23/492 . . . . . . {Bases or plates (or solder therefor)}  
23/4922 . . . . . . {having a heterogeneous or anisotropic structure}  
23/4924 . . . . . . {characterised by the materials}  
23/4926 . . . . . . {the materials containing semiconductor material}  
23/4928 . . . . . . {the materials containing carbon}  
23/495 . . . . . . Lead-frames {or other flat leads (H01L 23/498 takes precedence; lead frame interconnections between components H01L 23/52)}  
23/49503 . . . . . . {characterised by the die pad}  
23/49506 . . . . . . {an insulative substrate being used as a diepad, e.g. ceramic, plastic (H01L 23/49531 takes precedence)}  
23/4951 . . . . . . {Chip-on-leads or leads-on-chip techniques, i.e. inner lead fingers being used as die pad}  
23/49513 . . . . . . {having bonding material between chip and die pad}  
23/49517 . . . . . . {Additional leads}  
23/4952 . . . . . . {the additional leads being a bump or a wire}  
23/49524 . . . . . . {the additional leads being a tape carrier or flat leads}  
23/49527 . . . . . . {the additional leads being a multilayer}  
23/4953 . . . . . . {the additional leads being a wiring board}  
23/49534 . . . . . . {Multi-layer}  
23/49537 . . . . . . {Plurality of lead frames mounted in one device}  
23/49541 . . . . . . {Geometry of the lead-frame}  
23/49544 . . . . . . {Deformation absorbing parts in the lead frame plane, e.g. meanderline shape (H01L 23/49562 takes precedence)}  
23/49548 . . . . . . {Cross section geometry (H01L 23/49562 takes precedence)}  
23/49551 . . . . . . {characterised by bent parts}  
23/49555 . . . . . . {the bent parts being the outer leads}  
23/49558 . . . . . . {Insulating layers on lead frames, e.g. bridging members}  
23/4956 . . . . . . {for devices being provided for in H01L 29/00}  
23/49565 . . . . . . {Side rails of the lead frame, e.g. with perforations, sprocket holes}  
23/49568 . . . . . . {specifically adapted to facilitate heat dissipation}  
23/49572 . . . . . . {consisting of thin flexible metallic tape with or without a film carrier (H01L 23/49503 - H01L 23/49568 and H01L 23/49575 - H01L 23/49579 take precedence)}  
23/49575 . . . . . . {Assemblies of semiconductor devices on lead frames}  
23/49579 . . . . . . {characterised by the materials of the lead frames or layers thereon}  
23/49582 . . . . . . {Metallic layers on lead frames}  
23/49586 . . . . . . {Insulating layers on lead frames}  
23/49589 . . . . . . {Capacitor integral with or on the leadframe}  
23/49593 . . . . . . {Battery in combination with a leadframe}  
23/49596 . . . . . . {Oscillators in combination with lead-frames}  
23/498 . . . . . . {Leads, i.e. metallisations or lead-frames} on insulating substrates, {e.g. chip carriers (shape of the substrate H01L 23/13)}  
23/49805 . . . . . . {the leads being also applied on the sidewalls or the bottom of the substrate, e.g. leadless packages for surface mounting}  
23/49811 . . . . . . {Additional leads joined to the metallisation on the insulating substrate, e.g. pins, bumps, wires, flat leads (H01L 23/49827 takes precedence)}  
23/49816 . . . . . . {Spherical bumps on the substrate for external connection, e.g. ball grid arrays [BGA]}
the device in operation from one component to another. Arrangements for conducting electric current within semiconductor body insulating layers inseparably formed on the semiconductor chip support structure consisting of a plurality of insulating substrates.

(Geometry or layout)

(for devices being provided for in H01L 29/00)

(Flexible insulating substrates (H01L 23/4972 and H01L 23/4985 take precedence))

(for flat-cards, e.g. credit cards (cards per se G06K 19/00))

(Lead-frames fixed on or encapsulated in insulating substrates (H01L 23/4985, H01L 23/49805 take precedence))

(characterised by the materials (materials of the substrates H01L 23/14, of the lead-frames H01L 23/49579))

(the conductive materials containing semiconductor material)

(Carbon, e.g. fullerenes (superconducting fullerenes H01L 39/123))

(the conductive materials containing organic materials or pastes, e.g. for thick films (for printed circuits H05K 10/02))

(the conductive materials containing superconducting material)

(Materials of the insulating layers or coatings)

for integrated circuit devices, e.g. power bus, number of leads (H01L 23/498 - H01L 23/498 take precedence)

Arrangements for conducting electric current within the device in operation from one component to another, i.e. interconnections, e.g. wires, lead frames (optical interconnections G02B 6/00)

including external interconnections consisting of a multilayer structure of conductive and insulating layers inseparably formed on the semiconductor body

Crossover interconnections

Capacitive arrangements or effects of. or between wiring layers (other capacitive arrangements H01L 23/642)

Capacitor integral with wiring layers

Shielding layers formed together with wiring layers

Via connections in a multilevel interconnection structure

Inductive arrangements or effects of. or between, wiring layers (other inductive arrangements H01L 23/645)

Resistive arrangements or effects of. or between, wiring layers (other resistive arrangements H01L 23/647)

with adaptable interconnections

comprising anti-fuses, i.e. connections having their state changed from non-conductive to conductive)

(Comprising fuses, i.e. connections having their state changed from conductive to non-conductive)

(the change of state resulting from the use of an external beam, e.g. laser beam or ion beam)

(Aluminium alloys)

(Additional layers associated with aluminium layers, e.g. adhesion, barrier, cladding layers)

(Additional layers associated with copper layers, e.g. adhesion, barrier, cladding layers)

(the principal metal being a noble metal, e.g. gold)

(Noble-metal alloys)

(Additional layers associated with noble-metal layers, e.g. adhesion, barrier, cladding layers)

(the principal metal being a refractory metal)

(Refractory-metal alloys)

(Additional layers associated with refractory-metal layers, e.g. adhesion, barrier, cladding layers)

(containing semiconductor material, e.g. polysilicon)

(containing carbon, e.g. fullerenes (superconducting fullerenes H01L 39/123))

(containing conductive organic materials or pastes, e.g. conductive adhesives, inks)

(containing superconducting materials)

(Insulating materials)

(Stacked insulating layers)

including internal interconnections, e.g. cross-under constructions (internal lead connections H01L 23/481)

the interconnection structure between a plurality of semiconductor chips being formed on, or in, insulating substrates (H05K takes precedence; manufacture or treatment H01L 21/4846) ; mountings per se H01L 23/12; [materials H01L 23/49866])

(Crossover interconnections, e.g. bridge steppers)

(Adaptable interconnections, e.g. for engineering changes)
23/5383 . . . [Multilayer substrates (H01L 23/5385 takes precedence; multilayer metallisation on monolayer substrates H01L 23/538)]

23/5384 . . . [Conductive vias through the substrate with or without pins, e.g. buried coaxial conductors (H01L 23/5383, H01L 23/5385 take precedence; pins attached to insulating substrates H01L 23/4981)]

23/5385 . . . [Assembly of a plurality of insulating substrates]

23/5386 . . . [Geometry or layout of the interconnection structure]

23/5387 . . . [Flexible insulating substrates (H01L 23/5388 takes precedence)]

23/5388 . . . [for flat cards, e.g. credit cards (cards per se G06K 19/00)]

23/5389 . . . [the chips being integrally enclosed by the interconnect and support structures]

23/544 Marks applied to semiconductor devices (or parts), e.g. registration marks, alignment structures, wafer maps (test patterns for characterising or monitoring manufacturing processes H01L 22/00)

NOTE
When classifying in group H01L 23/544, details are to be further indexed by using the indexing codes chosen from H01L 2223/544 and subgroups

23/552 Protection against radiation, e.g. light (or electromagnetic waves)

23/556 . . . against alpha rays

23/562 [Protection against mechanical damage (H01L 23/02, H01L 23/28 take precedence)]

23/564 [Details not otherwise provided for, e.g. protection against moisture (getters H01L 23/26)]

23/57 [Protection from inspection, reverse engineering or tampering]

23/573 . . . [using passive means]

23/576 . . . [using active circuits]

23/58 Structural electrical arrangements for semiconductor devices not otherwise provided for (e.g. in combination with batteries (H01L 23/49593, H01L 23/49596 take precedence))

23/585 . . . [comprising conductive layers or plates or strips or rods or rings (H01L 23/60, H01L 23/62, H01L 23/64, H01L 23/66 take precedence)]

23/60 Protection against electrostatic charges or discharges, e.g. Faraday shields (in general H05F)

23/62 Protection against overvoltage, e.g. fuses, shunts

23/64 Impedance arrangements

23/642 . . . [Capacitive arrangements (H01L 23/49589, H01L 23/645, H01L 23/647, H01L 23/66 take precedence; capacitive effects between wiring layers on the semiconductor body H01L 23/5222)]

23/645 . . . [Inductive arrangements (H01L 23/647, H01L 23/66 take precedence)]

23/647 . . . [Resistive arrangements (H01L 23/66, H01L 23/62 take precedence)]

23/66 High-frequency adaptations

NOTE
When classifying in group H01L 23/66, details are to be further indexed by using the

24/00 [Arrangements for connecting or disconnecting semiconductor or solid-state bodies; Methods or apparatus related thereto]

NOTES
1. This group does not cover:
   • details of semiconductor bodies or of electrodes of devices provided for in group H01L 29/00, which details are covered by that group;
   • details peculiar to devices provided for in a single main group of groups H01L 31/00 - H01L 51/00, which details are covered by those groups.
   • printed circuits, which are covered by groups H05K 1/00 - H05K 1/189;
   • apparatus or manufacturing processes for printed circuits, which are covered by groups H05K 3/00 - H05K 3/4685;
   • manufacture or treatment of parts, which are covered by group H01L 21/48 and subgroups except H01L 21/4885 - H01L 21/4896;
   • assemblies of semiconductor devices, which are covered by groups H01L 21/50 - H01L 21/568;
   • applying interconnections to be used for carrying current between separate components within a device, which is covered by group H01L 21/768 and subgroups;
   • containers or seals, which are covered by groups H01L 23/02 - H01L 23/10;
   • mountings, which are covered by groups H01L 23/12 - H01L 23/15 and subgroups;
   • arrangements for cooling, heating, ventilating or temperature compensation, which are covered by groups H01L 23/34 - H01L 23/4735;
   • arrangements for conducting electric current, which are covered by groups H01L 23/48 - H01L 23/50, and by groups H01L 23/52 - H01L 23/5399;
   • structural electrical arrangements, which are covered by groups H01L 24/00 - H01L 23/66;
   • assemblies of semiconductor or other solid state devices, which are covered by groups H01L 25/00 - H01L 25/18.

2. In this group the following indexing codes are used: H01L 24/00, H01L 2224/00, H01L 2924/00, and subgroups thereof

24/01 [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]
24/02 . . . [Bonding areas (on insulating substrates, e.g. chip carriers, H01L 23/49816, H01L 23/49838, H01L 23/5389); Manufacturing methods related thereto]

WARNING

Groups H01L 24/02 – H01L 24/09 are incomplete pending reclassification of documents from groups H01L 24/02 and H01L 24/10.

Groups H01L 24/24 – H01L 24/25 and H01L 24/10 should be considered in order to perform a complete search.

24/03 . . . . . [Manufacturing methods]

24/04 . . . . . [Structure, shape, material or disposition of the bonding areas prior to the connecting process]

24/05 . . . . . [of an individual bonding area]

24/06 . . . . . [of a plurality of bonding areas]

24/07 . . . . . [Structure, shape, material or disposition of the bonding areas after the connecting process]

24/08 . . . . . [of an individual bonding area]

24/09 . . . . . [of a plurality of bonding areas]

24/10 . . . . . [Bump connectors (bumps on insulating substrates, e.g. chip carriers, H01L 23/49816); Manufacturing methods related thereto]

24/11 . . . . . [Manufacturing methods (for bumps on insulating substrates H01L 21/4853)]

24/12 . . . . . [Structure, shape, material or disposition of the bump connectors prior to the connecting process]

24/13 . . . . . [of an individual bump connector]

24/14 . . . . . [of a plurality of bump connectors]

24/15 . . . . . [Structure, shape, material or disposition of the bump connectors after the connecting process]

24/16 . . . . . [of an individual bump connector]

24/17 . . . . . [of a plurality of bump connectors]

24/18 . . . . . [High density interconnect [HDI] connectors; Manufacturing methods related thereto (interconnection structure between a plurality of semiconductor chips H01L 23/5389)]

WARNING

Groups H01L 24/18 – H01L 24/25 are incomplete pending reclassification of documents from groups H01L 24/18 and H01L 24/82.

Groups H01L 24/24 – H01L 24/25 and H01L 24/82 should be considered in order to perform a complete search.

24/19 . . . . . [Manufacturing methods of high density interconnect preforms]

24/20 . . . . . [Structure, shape, material or disposition of high density interconnect preforms]

24/23 . . . . . [Structure, shape, material or disposition of the high density interconnect connectors after the connecting process]

24/24 . . . . . [of an individual high density interconnect connector]

24/25 . . . . . [of a plurality of high density interconnect connectors]

24/26 . . . . . [Layer connectors, e.g. plate connectors, solder or adhesive layers; Manufacturing methods related thereto]

24/27 . . . . . [Manufacturing methods]

24/28 . . . . . [Structure, shape, material or disposition of the layer connectors prior to the connecting process]

24/29 . . . . . [of an individual layer connector]

24/30 . . . . . [of a plurality of layer connectors]

24/31 . . . . . [Structure, shape, material or disposition of the layer connectors after the connecting process]

24/32 . . . . . [of an individual layer connector]

24/33 . . . . . [of a plurality of layer connectors]

24/34 . . . . . [Strap connectors, e.g. copper straps for grounding power devices; Manufacturing methods related thereto]

WARNING

Groups H01L 24/34 – H01L 24/41 are incomplete pending reclassification of documents from groups H01L 24/34, H01L 24/01, H01L 24/42, and H01L 24/85.

Groups H01L 24/34 – H01L 24/41, and H01L 24/01, H01L 24/42, H01L 24/85 should be considered in order to perform a complete search.

24/35 . . . . . [Manufacturing methods]

24/36 . . . . . [Structure, shape, material or disposition of the strap connectors prior to the connecting process]

24/37 . . . . . [of an individual strap connector]

24/38 . . . . . [of a plurality of strap connectors]

24/39 . . . . . [Structure, shape, material or disposition of the strap connectors after the connecting process]

24/40 . . . . . [of an individual strap connector]

24/41 . . . . . [of a plurality of strap connectors]

24/42 . . . . . [Wire connectors; Manufacturing methods related thereto]

24/43 . . . . . [Manufacturing methods]

WARNING

Group H01L 24/43 is incomplete pending reclassification of documents from groups H01L 24/42 and H01L 24/85.

Groups H01L 24/43, H01L 24/42, and H01L 24/85 should be considered in order to perform a complete search.

24/44 . . . . . [Structure, shape, material or disposition of the wire connectors prior to the connecting process]

WARNING

Group H01L 24/44 is incomplete pending reclassification of documents from groups H01L 24/42 and H01L 24/85.

Groups H01L 24/44, H01L 24/42, and H01L 24/85 should be considered in order to perform a complete search.

24/45 . . . . . [of an individual wire connector]

24/46 . . . . . [of a plurality of wire connectors]
WARNING

Group H01L 24/47 is incomplete pending reclassification of documents from groups H01L 24/42 and H01L 24/85.
Groups H01L 24/47 and H01L 24/42, H01L 24/85 should be considered in order to perform a complete search.

WARNING

Group H01L 24/40 is incomplete pending reclassification of documents from group H01L 24/86.
Groups H01L 24/40 and H01L 24/86 should be considered in order to perform a complete search.

WARNING

Group H01L 24/84 is incomplete pending reclassification of documents from group H01L 24/85.
Group H01L 24/84 and H01L 24/85 should be considered in order to perform a complete search.

WARNING

Group H01L 24/93 is incomplete pending reclassification of documents from groups H01L 24/80 – H01L 24/90.
Groups H01L 24/93 and H01L 24/80 – H01L 24/90 should be considered in order to perform a complete search.
Assemblies consisting of a plurality of individual semiconductor or other solid state devices: Multistep manufacturing processes thereof

Devices consisting of a plurality of semiconductor or other solid-state components formed in or on a common substrate

NOTE

When classifying in group H01L 25/105, details of the assemblies are to be further indexed by using the indexing codes chosen from H01L 2225/1005 and subgroups

NOTE

Group H01L 25/112 takes precedence over groups H01L 25/115 and H01L 25/117

NOTE

Group H01L 25/112 takes precedence over groups H01L 25/115 and H01L 25/117

NOTE

Group H01L 25/0652 takes precedence over groups H01L 25/0655 and H01L 25/0657

NOTE

Group H01L 25/071 takes precedence over groups H01L 25/072 and H01L 25/074

25/071 . . . . . [the devices being arranged next and on each other, i.e. mixed assemblies]

25/072 . . . . . [the devices being arranged next to each other]

25/073 . . . . . [Apertured devices mounted on one or more rods passed through the apertures]

25/074 . . . . . [Stacked arrangements of non-apertured devices]

25/075 . . . . . [the devices being of a type provided for in group H01L 33/00]

25/0753 . . . . . [the devices being arranged next to each other]

25/0756 . . . . . [Stacked arrangements of devices]

25/10 . . . . . the devices having separate containers

25/105 . . . . . [the devices being of a type provided for in group H01L 27/00]

NOTE

When classifying in group H01L 25/105, details of the assemblies are to be further indexed by using the indexing codes chosen from H01L 2225/1005 and subgroups

NOTE

Group H01L 25/112 takes precedence over groups H01L 25/115 and H01L 25/117

25/112 . . . . . . [Mixed assemblies]

25/115 . . . . . . [the devices being arranged next to each other]

25/117 . . . . . . [Stacked arrangements of devices]

25/13 . . . . . . [the devices being of a type provided for in group H01L 33/00]

25/16 . . . . . . the devices being of types provided for in two or more different main groups of H01L 27/00 - H01L 49/00 (and H01L 51/00), e.g. forming hybrid circuits ([interconnections for hybrid circuits H01L 23/5389])

25/162 . . . . . . [the devices being mounted on two or more different substrates]

25/165 . . . . . . [Containers]

25/167 . . . . . . [comprising optoelectronic devices, e.g. LED, photodiodes]

25/18 . . . . . . the devices being of types provided for in two or more different subgroups of the same main group of groups H01L 27/00 - H01L 51/00 (comprising devices provided for in H01L 27/144 and subgroups, see H01L 27/144 and subgroups)

25/50 . . . . . . [Multistep manufacturing processes of assemblies consisting of devices, each device being of a type provided for in group H01L 27/00 or H01L 29/00 (H01L 21/50 takes precedence)]

27/00

Devices consisting of a plurality of semiconductor or other solid-state components formed in or on a common substrate (details thereof H01L 23/00, H01L 29/00, H01L 51/00; assemblies consisting of a plurality of individual solid state devices H01L 25/00)

NOTES

1. In this group, with the exception of groups H01L 27/115 - H01L 27/11597, the last place priority rule is applied, i.e. at each hierarchical level, in the absence of an indication to the contrary, classification is made in the last appropriate place.

2. When classifying in this group, subject matter relating to electrically programmable read-only memories is classified in group H01L 27/115, irrespective of the last place priority rule.
NOTE

In groups H01L 27/01 - H01L 27/26, in the absence of an indication to the contrary, classification is made in the last appropriate place.

27/0127 . . . . comprising only passive thin-film or thick-film elements formed on a common insulating substrate [(passive two-terminal components without a potential-jump or surface barrier for integrated circuits, details thereof and multistep manufacturing processes therefor H01L 28/00)]

27/027 . . . . 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

27/02037 . . . . [Particular design considerations for integrated circuits]

27/02077 . . . . [Geometrical layout of the components, e.g. computer aided design; custom LSI, semi-custom LSI, standard cell technique]

27/02117 . . . . [adapted for requirements of temperature]

27/02147 . . . . [for internal polarisation, e.g. I2L]

27/02187 . . . . [of field effect structures]

27/02227 . . . . [Charge pumping, substrate bias generation structures]

27/02257 . . . . [Charge injection in static induction transistor logic structures [SITL]]

27/02297 . . . . [of bipolar structures]

27/02337 . . . . [Integrated injection logic structures [I2L]]

27/02377 . . . . [using vertical injector structures]

27/0247 . . . . [using field effect injector structures]

27/02447 . . . . [I2L structures integrated in combination with analog structures]

27/02487 . . . . [for electrical or thermal protection, e.g. electrostatic discharge [ESD] protection]

27/02517 . . . . [for MOS devices]

27/02557 . . . . [using diodes as protective elements]

27/02597 . . . . [using bipolar transistors as protective elements]

27/02627 . . . . [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]

27/02667 . . . . [using field effect transistors as protective elements]

27/0277 . . . . [specially adapted to provide an electrical current path other than the field effect induced current path]

27/02747 . . . . [involving a parasitic bipolar transistor triggered by the electrical biasing of the gate electrode of the field effect transistor, e.g. gate coupled transistors]

27/0277 . . . . [involving a parasitic bipolar transistor triggered by the local electrical biasing of the layer acting as base of said parasitic bipolar transistor]

27/02817 . . . . [field effect transistors in a "Darlington-like" configuration]

27/02857 . . . . [bias arrangements for gate electrode of field effect transistors, e.g. RC networks, voltage partitioning circuits (H01L 27/0281 takes precedence)]

27/02887 . . . . [using passive elements as protective elements, e.g. resistors, capacitors, inductors, spark-gaps]

27/02927 . . . . [using a specific configuration of the conducting means connecting the protective devices, e.g. ESD buses]

27/02967 . . . . [involving a specific disposition of the protective devices]

27/047 . . . . the substrate being a semiconductor body

27/067 . . . . including a plurality of individual components in a non-repetitive configuration

27/06057 . . . . [integrated circuits made of compound material, e.g. A3B1]

27/06117 . . . . [integrated circuits having a two-dimensional layout of components without a common active region]

27/06177 . . . . [comprising components of the field-effect type (H01L 27/0251 takes precedence)]

27/06237 . . . . [in combination with bipolar transistors]

27/06297 . . . . [in combination with diodes, or resistors, or capacitors]

27/06357 . . . . [in combination with bipolar transistors and diodes, or resistors, or capacitors]

27/06417 . . . . [without components of the field effect type]

27/06477 . . . . [Bipolar transistors in combination with diodes, or capacitors, or resistors, e.g. vertical bipolar transistor and bipolar lateral transistor and resistor]

27/06527 . . . . [Vertical bipolar transistor in combination with diodes, or capacitors, or resistors]

27/06587 . . . . [Vertical bipolar transistor in combination with resistors or capacitors]

27/06647 . . . . [Vertical bipolar transistor in combination with diodes]

27/0677 . . . . [Lateral bipolar transistor in combination with diodes, or capacitors, or resistors]

27/06767 . . . . [comprising combinations of diodes, or capacitors or resistors]

27/06827 . . . . [comprising combinations of capacitors and resistors]

27/06887 . . . . [Integrated circuits having a three-dimensional layout]

27/06947 . . . . [comprising components formed on opposite sides of a semiconductor substrate]

27/077 . . . . the components having an active region in common
<table>
<thead>
<tr>
<th>CPC Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>27/0705</td>
<td>[comprising components of the field effect type]</td>
</tr>
<tr>
<td>27/0711</td>
<td>[in combination with bipolar transistors and diodes, or capacitors, or resistors]</td>
</tr>
<tr>
<td>27/0716</td>
<td>[in combination with vertical bipolar transistors and diodes, or capacitors, or resistors]</td>
</tr>
<tr>
<td>27/0722</td>
<td>[in combination with lateral bipolar transistors and diodes, or capacitors, or resistors]</td>
</tr>
<tr>
<td>27/0727</td>
<td>[in combination with diodes, or capacitors or resistors]</td>
</tr>
<tr>
<td>27/0733</td>
<td>[in combination with capacitors only]</td>
</tr>
<tr>
<td>27/0738</td>
<td>[in combination with resistors only]</td>
</tr>
<tr>
<td>27/0744</td>
<td>[without components of the field effect type]</td>
</tr>
<tr>
<td>27/075</td>
<td>[Bipolar transistors in combination with diodes, or capacitors, or resistors, e.g. lateral bipolar transistor, and vertical bipolar transistor and resistor]</td>
</tr>
<tr>
<td>27/0755</td>
<td>[Vertical bipolar transistor in combination with diodes, or capacitors, or resistors]</td>
</tr>
<tr>
<td>27/0761</td>
<td>[Vertical bipolar transistor in combination with diodes only]</td>
</tr>
<tr>
<td>27/0766</td>
<td>[with Schottky diodes only]</td>
</tr>
<tr>
<td>27/0772</td>
<td>[Vertical bipolar transistor in combination with resistors only]</td>
</tr>
<tr>
<td>27/0777</td>
<td>[Vertical bipolar transistor in combination with capacitors only]</td>
</tr>
<tr>
<td>27/0783</td>
<td>[Lateral bipolar transistors in combination with diodes, or capacitors, or resistors]</td>
</tr>
<tr>
<td>27/0788</td>
<td>[comprising combinations of diodes or capacitors or resistors]</td>
</tr>
<tr>
<td>27/0794</td>
<td>[Combinations of capacitors and resistors]</td>
</tr>
<tr>
<td>27/08</td>
<td>including only semiconductor components of a single kind</td>
</tr>
<tr>
<td>27/0802</td>
<td>[Resistors only]</td>
</tr>
<tr>
<td>27/0805</td>
<td>[Capacitors only]</td>
</tr>
<tr>
<td>27/0808</td>
<td>[Varactor diodes]</td>
</tr>
<tr>
<td>27/0811</td>
<td>[MIS diodes]</td>
</tr>
<tr>
<td>27/0814</td>
<td>[Diodes only]</td>
</tr>
<tr>
<td>27/0817</td>
<td>[Thyristors only]</td>
</tr>
<tr>
<td>27/082</td>
<td>including bipolar components only</td>
</tr>
<tr>
<td>27/0821</td>
<td>[Combination of lateral and vertical transistors only]</td>
</tr>
<tr>
<td>27/0823</td>
<td>[including vertical bipolar transistors only]</td>
</tr>
<tr>
<td>27/0825</td>
<td>[Combination of vertical direct transistors of the same conductivity type having different characteristics, e.g. Darlington transistors]</td>
</tr>
<tr>
<td>27/0826</td>
<td>[Combination of vertical complementary transistors]</td>
</tr>
<tr>
<td>27/0828</td>
<td>[Combination of direct and inverse vertical transistors]</td>
</tr>
<tr>
<td>27/085</td>
<td>including field-effect components only</td>
</tr>
<tr>
<td>27/088</td>
<td>the components being field-effect transistors with insulated gate</td>
</tr>
<tr>
<td>27/0883</td>
<td>[Combination of depletion and enhancement field effect transistors]</td>
</tr>
<tr>
<td>27/0886</td>
<td>[including transistors with a horizontal current flow in a vertical sidewall of a semiconductor body, e.g. FinFET, MuGFET]</td>
</tr>
<tr>
<td>27/092</td>
<td>complementary MIS field-effect transistors</td>
</tr>
<tr>
<td>27/0921</td>
<td>[Means for preventing a bipolar, e.g. thyristor, action between the different transistor regions, e.g. Latchup prevention]</td>
</tr>
<tr>
<td>27/0922</td>
<td>[Combination of complementary transistors having a different structure, e.g. stacked CMOS, high-voltage and low-voltage CMOS]</td>
</tr>
<tr>
<td>27/0924</td>
<td>[including transistors with a horizontal current flow in a vertical sidewall of a semiconductor body, e.g. FinFET, MuGFET]</td>
</tr>
<tr>
<td>27/0925</td>
<td>[comprising an N-well only in the substrate]</td>
</tr>
<tr>
<td>27/0927</td>
<td>[comprising a P-well only in the substrate]</td>
</tr>
<tr>
<td>27/0928</td>
<td>[comprising both N- and P- wells in the substrate, e.g. twin-tub]</td>
</tr>
<tr>
<td>27/095</td>
<td>the components being Schottky barrier gate field-effect transistors</td>
</tr>
<tr>
<td>27/098</td>
<td>the components being PN junction gate field-effect transistors</td>
</tr>
<tr>
<td>27/10</td>
<td>including a plurality of individual components in a repetitive configuration</td>
</tr>
<tr>
<td>27/101</td>
<td>[including resistors or capacitors only]</td>
</tr>
<tr>
<td>27/102</td>
<td>including bipolar components</td>
</tr>
<tr>
<td>27/1021</td>
<td>[including diodes only]</td>
</tr>
<tr>
<td>27/1022</td>
<td>[including bipolar transistors]</td>
</tr>
<tr>
<td>27/1023</td>
<td>[Bipolar dynamic random access memory structures]</td>
</tr>
<tr>
<td>27/1024</td>
<td>[Arrays of single bipolar transistors only, e.g. read only memory structures]</td>
</tr>
<tr>
<td>27/1025</td>
<td>[Static bipolar memory cell structures]</td>
</tr>
<tr>
<td>27/1026</td>
<td>[Bipolar electrically programmable memory structures (using fuses H01L 23/525)]</td>
</tr>
<tr>
<td>27/1027</td>
<td>[Thyristors]</td>
</tr>
<tr>
<td>27/1028</td>
<td>[Double base diodes]</td>
</tr>
<tr>
<td>27/105</td>
<td>including field-effect components</td>
</tr>
</tbody>
</table>

**NOTE**

In this group and its subgroups classification is made in any appropriate place.

<table>
<thead>
<tr>
<th>CPC Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>27/1052</td>
<td>[Memory structures and multistep manufacturing processes therefor not provided for in groups H01L 27/1055 - H01L 27/112]</td>
</tr>
<tr>
<td>27/1055</td>
<td>[comprising charge coupled devices of the so-called bucket brigade type]</td>
</tr>
<tr>
<td>27/1057</td>
<td>[comprising charge coupled devices (CCD) or charge injection devices (CJD)]</td>
</tr>
</tbody>
</table>
Dynamic random access memory structures

**NOTE**
In this group and its subgroups, classification is made in any appropriate place.

- [27/108] {comprising floating-body transistors, e.g. floating-body cells}
- [27/10802] {with one-transistor one-capacitor memory cells}
- [27/10803] {the storage electrode stacked over transistor}
- [27/10811] {with bit line higher than capacitor}
- [27/10814] {with capacitor higher than bit line level}
- [27/10817] {the storage electrode having multiple wings}
- [27/1082] {the capacitor extending under transfer transistor area}
- [27/10823] {the transistor having a trench structure in the substrate}
- [27/10826] {the transistor being of the FinFET type}
- [27/10829] {the capacitor being in a substrate trench}
- [27/10832] {the capacitor extending under or around transfer transistor area}
- [27/10835] {having storage electrode extension stacked over transistor}
- [27/10838] {the capacitor and the transistor being in one trench}
- [27/10841] {the transistor being vertical}
- [27/10844] {Multistep manufacturing methods}
- [27/10847] {for structures comprising one transistor one-capacitor memory cells}
- [27/1085] {with at least one step of making the capacitor or connections thereto}
- [27/10852] {the capacitor extending over the access transistor}
- [27/10855] {with at least one step of making a connection between transistor and capacitor, e.g. plug}
- [27/10858] {the capacitor extending under the access transistor area}
- [27/10861] {the capacitor being in a substrate trench}
- [27/10864] {in combination with a vertical transistor}
- [27/10867] {with at least one step of making a connection between transistor and capacitor, e.g. buried strap}
- [27/1087] {with at least one step of making the trench}
- [27/10873] {with at least one step of making the transistor}

[27/10876] {the transistor having a trench structure in the substrate (vertical transistor in combination with a capacitor formed in a substrate trench H01L 27/10864)}
- [27/10879] {the transistor being of the FinFET type}
- [27/10882] {with at least one step of making a data line}
- [27/10885] {with at least one step of making a bit line}
- [27/10888] {with at least one step of making a bit line contact}
- [27/10891] {with at least one step of making a word line}
- [27/10894] {with simultaneous manufacture of periphery and memory cells}
- [27/10897] {Peripheral structures}
- [27/11] {Static random access memory structures}
- [27/1104] {the load element being a MOSFET transistor}
- [27/1108] {the load element being a thin film transistor}
- [27/1112] {the load element being a resistor (resistors for integrated circuits H01L 28/20, H01L 29/8605)}
- [27/1116] {Peripheral circuit region}
- [27/112] {Read-only memory structures [ROM] and multistep manufacturing processes therefor}
- [27/11206] {Programmable ROM [PROM], e.g. memory cells comprising a transistor and a fuse or an antifuse}
- [27/11213] {ROM only}
- [27/1122] {with source and drain on the same level, e.g. lateral transistors}
- [27/11226] {Source or drain contact programmed}
- [27/11233] {Gate programmed, e.g. different gate material or no gate}
- [27/1124] {Gate contact programmed}
- [27/11246] {Gate dielectric programmed, e.g. different thickness}
- [27/11253] {Doping programmed, e.g. mask ROM}
- [27/1126] {Entire channel doping programmed}
- [27/11266] {Source or drain doping programmed}
- [27/11273] {with source and drain on different levels, e.g. vertical channel}
- [27/1128] {with transistors on different levels, e.g. 3D ROM}
- [27/11286] {Peripheral circuit regions}
- [27/11293] {of memory structures of the ROM-only type}
- [27/115] {Electrically programmable read-only memories; Multistep manufacturing processes therefor}
- [27/11502] {with ferroelectric memory capacitors}
- [27/11504] {characterised by the top-view layout}
- [27/11507] {characterised by the memory core region}
characterised by the peripheral circuit region

characterised by the boundary region between the core and peripheral circuit regions

characterised by the three-dimensional arrangements, e.g. with cells on different height levels with floating gate

characterised by the top-view layout

characterised by the memory core region (three-dimensional arrangements H01L 27/11551)

characterised by the peripheral circuit region

of memory regions comprising cell select transistors, e.g. NAND

Simultaneous manufacturing of periphery and memory cells including only one type of peripheral transistor with a control gate layer also being used as part of the peripheral transistor

with an inter-gate dielectric layer also being used as part of the peripheral transistor

with a floating-gate layer also being used as part of the peripheral transistor

with a tunnel dielectric layer also being used as part of the peripheral transistor including different types of peripheral transistor

characterised by the boundary region between the core and peripheral circuit regions characterised by three-dimensional arrangements, e.g. with cells on different height levels with source and drain on different levels, e.g. with sloping channels

the channels comprising vertical portions, e.g. U-shaped channels

characterised by three-dimensional arrangements, e.g. cells on different height levels

Masterslice integrated circuits [using bipolar technology]

using field effect technology

[A3B5 or A3B6 gate arrays]

[CMOS gate arrays]

[Microarchitecture]

[Basic cell P to N transistor count]

[4-T CMOS basic cell]

[5-T CMOS basic cell]

[6-T CMOS basic cell]

[7-T CMOS basic cell]

[8-T CMOS basic cell]

[relative P to N transistor sizes]

[for current drive capability]

[for delay time adaptation]

[for capacitive loading]

[Isolation techniques]

[FET isolation]

[LOCOS]

[Degree of specialisation for implementing specific functions]

[Implementation of digital circuits]

[Implementation of memory functions]

[Implementation of analog circuits]

[Resistors and capacitors]

[Hybrid analog or digital]

[Embedded IO cells]

[Transmission gate]
27/1237 . . . . . (with a different composition, shape, layout or thickness of the gate insulator in different devices)

27/124 . . . . . (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 H01L 23/52))

27/1244 . . . . . (for preventing breakage, peeling or short circuiting)

27/1245 . . . . . (with a particular composition or shape of the interlayer dielectric specially adapted to the circuit arrangement)

27/1251 . . . . . (comprising TFTs having a different architecture, e.g. top- and bottom gate TFTs)

27/1255 . . . . . (integrated with passive devices, e.g. auxiliary capacitors)

27/1259 . . . . . (Multistep manufacturing methods)

27/1262 . . . . . (with a particular formation, treatment or coating of the substrate)

27/1266 . . . . . (the substrate on which the devices are formed not being the final device substrate, e.g. using a temporary substrate)

27/127 . . . . . (with a particular formation, treatment or patterning of the active layer specially adapted to the circuit arrangement)

27/1274 . . . . . (using crystallisation of amorphous semiconductor or recrystallisation of crystalline semiconductor)

27/1277 . . . . . (using a crystallisation promoting species, e.g. local introduction of Ni catalyst)

27/1281 . . . . . (by using structural features to control crystal growth, e.g. placement of grain filters)

27/1285 . . . . . (using control of the annealing or irradiation parameters, e.g. using different scanning direction or intensity for different transistors)

27/1288 . . . . . (employing particular masking sequences or specially adapted masks, e.g. half-tone mask)

27/1292 . . . . . (using liquid deposition, e.g. printing)

27/1296 . . . . . (adapted to increase the uniformity of device parameters)

27/13 . . . . . combined with thin-film or thick-film passive components
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 H01L 31/14; couplings of light guides with opoelectronic elements G02B 6/42)

Energy conversion devices (photovoltaic modules or arrays of single photovoltaic cells comprising bypass diodes integrated or directly associated with the devices H01L 31/0443; photovoltaic modules composed of a plurality of thin film solar cells deposited on the same substrate H01L 31/046)

[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]

Devices controlled by radiation

(with at least one potential jump or surface barrier)

[in a repetitive configuration]

Imager structures

WARNING

Groups H01L 27/146 – H01L 27/1493 are incomplete pending reclassification of documents from groups H04N 5/3696 and H04N 9/045.

Groups H04N 5/3696, H04N 9/045, and H01L 27/146 – H01L 27/1493 should be considered in order to perform a complete search.

[Structural or functional details thereof]

{Special geometry or disposition of pixel-elements, address-lines or gate-electrodes}

{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}

{Geometry of the photosensitive area}

{Pixel-elements with integrated switching, control, storage or amplification elements (scanning details of imagers H04N 3/15; circuitry of imagers H04N 5/3696)}

{characterised by the photosensitive area}

{involving a transistor}

{having a special gate structure}

{characterised by the channel of the transistor, e.g. channel having a doping gradient}

{Containers}

{Coatings}

{Colour filter arrangements}

{Optical shielding}

{Optical elements or arrangements associated with the device}

{Microlenses}

{Reflectors}

{Pixel isolation structures}

{Wafer-level processed structures}

{Assemblies, i.e. Hybrid structures}

{Interconnect structures}

{Structures specially adapted for transferring the charges across the imager perpendicular to the imaging plane}

{Back illuminated imager structures}

{Electronic components shared by two or more pixel-elements, e.g. one amplifier shared by two pixel elements}

{Photodiode arrays; MOS imagers}

{Colour imagers}

{Multicolour imagers having a stacked pixel-element structure, e.g. npn, npnnp or MQW elements}

{Infra-red imagers}

[of the hybrid type}

{Multispectral infra-red imagers, having a stacked pixel-element structure, e.g. npn, npnnp or MQW structures}

{Blooming suppression}

{Overflow drain structures}

[X-ray, gamma-ray or corpuscular radiation imagers (measuring X-, gamma- or corpuscular radiation G01T 1/00)]

{Direct radiation imagers structures}

[of the hybrid type}

{Indirect radiation imagers, e.g. using luminescent members}

{Imagers using a photodiode layer}

{Colour imagers}

{Infra-red imagers}

[of the hybrid type}

{Blooming suppression}

{Overflow drain structures}

[X-ray, gamma-ray or corpuscular radiation imagers (measuring X-, gamma- or corpuscular radiation G01T 1/00)]

{Contact-type imagers}

{Junction field effect transistor [JFET] imagers; static induction transistor [SIT] imagers}

{Bipolar transistor imagers}

{Processes or apparatus peculiar to the manufacture or treatment of these devices or parts thereof (not peculiar thereto H01L 21/00)}

{Process for coatings or optical elements}

{Wafer level processing}

{MOS based technologies}

{Assemblies, i.e. hybrid integration}

{Thin film technologies, e.g. amorphous, poly, micro- or nanocrystalline silicon}

{The active layers comprising only A,, B, compounds, e.g. GaAs, InP}

{The active layers comprising only A,, B, compounds, e.g. CdS, ZnS, CdTe}

{Post-treatment for the devices, e.g. annealing, impurity-gettering, shor-circuit elimination, recrystallisation}

{Charge coupled imagers (individual charge coupled devices H01L 29/765)
27/14806  . . . [Structural or functional details thereof]
27/14812  . . . [Special geometry or disposition of pixel-elements, address lines or gate-electrodes]
27/14818  . . . [Optical shielding]
27/14825  . . . [Linear CCD imagers]
27/14831  . . . [Area CCD imagers]
27/14837  . . . [Frame-interline transfer]
27/14843  . . . [Interline transfer]
27/1485  . . . [Frame transfer]
27/14856  . . . [Time-delay and integration]
27/14862  . . . [CID imagers]
27/14868  . . . [CCD or CID colour imagers]
27/14875  . . . [Infra-red CCD or CID imagers]
27/14881  . . . [of the hybrid type]
27/14887  . . . [Blooming suppression]
27/14893  . . . [comprising a photoconductive layer deposited on the CCD structure]
27/15  . . . including semiconductor components with at least one potential-jump barrier or surface barrier specially adapted for light emission
   (monolithically integrated components including semiconductor laser components H01S 5/026)
27/153  . . . [in a repetitive configuration, e.g. LED bars]
27/156  . . . [two-dimensional arrays]
27/16  . . . 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 H01L 23/38)
27/18  . . . including components exhibiting superconductivity
27/20  . . . including piezo-electric components; including electrostrictive components; including magnetostrictive components
27/22  . . . including components using galvano-magnetic effects, e.g. Hall effects; using similar magnetic field effects
27/222  . . . [Magnetic non-volatile memory structures, e.g. MRAM]
27/224  . . . [comprising two-terminal components, e.g. diodes, MIM elements]
27/226  . . . [comprising multi-terminal components, e.g. transistors]
27/228  . . . [of the field-effect transistor type]
27/24  . . . including solid state components for rectifying, amplifying or switching without a potential-jump barrier or surface barrier, e.g. resistance switching non-volatile memory structures]
27/2409  . . . [comprising two-terminal selection components, e.g. diodes]
27/2418  . . . [of the metal-insulator-metal type]
27/2427  . . . [of the Ovonic threshold switching type]
27/2436  . . . [comprising multi-terminal selection components, e.g. transistors]
27/2445  . . . [of the bipolar type]
27/2454  . . . [of the vertical channel field-effect transistor type]
27/2463  . . . [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]
27/2472  . . . [the switching components having a common active material layer]
27/2481  . . . [arranged in a direction perpendicular to the substrate, e.g. 3D cell arrays, details of the vertical layout]
27/249  . . . [the switching components being connected to a common vertical conductor]
27/26  . . . including bulk negative resistance effect components
27/265  . . . [Gunn effect devices]
27/28  . . . including components using organic materials as the active part, or using a combination of organic materials with other materials as the active part
27/281  . . . [Integrated circuits having a three-dimensional layout]
27/283  . . . [comprising components of the field-effect type]
27/285  . . . [Integrated circuits with a common active layer, e.g. cross point devices]
27/286  . . . [with an active region comprising an inorganic semiconductor]
27/288  . . . [Combination of organic light sensitive components with organic light emitting components, e.g. optocoupler]
27/30  . . . 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
   (combination of organic light sensitive components with organic light emitting components, e.g. optocoupler H01L 27/288)
27/301  . . . [Energy conversion devices]
27/302  . . . [comprising multiple junctions, e.g. tandem cells]
27/304  . . . [in form of a fiber or a tube, e.g. photovoltaic fibers]
27/305  . . . [Devices controlled by radiation]
27/307  . . . [Imager structures]

**WARNING**

Group H01L 27/307 is incomplete pending reclassification of documents from groups H04N 5/3696 and H04N 9/045.

Groups H04N 5/3696, H04N 9/045, and H01L 27/307 should be considered in order to perform a complete search.

27/308  . . . [Devices specially adapted for detecting X-ray radiation (measuring X-radiation G01T 1/00)]
27/32  . . . with components specially adapted for light emission, e.g. flat-panel displays using organic light-emitting diodes [OLED] (combination of organic light sensitive components with organic light emitting components, e.g. optocoupler H01L 27/288)
27/3202  . . . [OLEDs electrically connected in parallel]
27/3204  . . . [OLEDs electrically connected in series]
27/3206  . . . [Multi-colour light emission]
27/3209  . . . [using stacked OLED]
WARNING

Groups H01L 27/3213 – H01L 27/3218 are incomplete pending reclassification of documents from group H01L 27/3211. Groups H01L 27/3213 – H01L 27/3218 and H01L 27/3211 should be considered in order to perform a complete search.

[using more than three sub-pixels, e.g. RGBW]

[characterised by the geometrical arrangement of the RGB sub-pixels]

[using colour filters or colour changing media [CCM]]

{combined with dummy elements, i.e. non-functional features}

{OLED integrated with another component (H01L 27/3223 takes precedence)}

{the other component being a light sensitive element, e.g. inorganic solar cell, inorganic photodiode (H01L 27/288 takes precedence)}

{the other component being a touch screen}

{the other component being a light modulating element, e.g. electrochromic element, photochromic element, liquid crystal element}

{the other component being an imager structure (H01L 27/146 takes precedence)}

[Displays not provided for in group H01L 27/3241 and subgroups, e.g. segment-type displays]

{Light emitting logos}

{Matrix-type displays}

WARNING

From 1.2.2012 onwards, groups H01L 27/3295 and H01L 27/3297 are no longer used for classification of new documents. The backfile is being reclassified to H01L 27/3244 and H01L 27/3281 and subgroups thereof.

{Active matrix displays}

{Banks, i.e. pixel defining layers}

{Connection of the pixel electrode to the TFT}

[Double substrate, i.e. with OLED and TFT on different substrates}

{Electrical connection of the two substrates}

{Chiplets}

{Insulating layers formed between TFT elements and OLED elements}

{special geometry or disposition of pixel-elements}

{of TFT}

{of capacitor}

{Dual display, i.e. having two independent displays}

{Including photosensors to control luminance}

{Shielding, e.g. of TFT}

{including organic thin film transistors [OTFT]}

{Wiring lines}

{comprising structures specially adapted for lowering the resistance}

{Passive matrix displays}

{Including banks or shadow masks}

{Dual display, i.e. having two independent displays}

{Wiring lines}

{comprising structures specially adapted for lowering the resistance}

{Tiled displays}

{including banks or shadow masks}

{Wiring lines, e.g. power supply lines}

{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 H01L 22/00; integration methods H01L 21/70; Integrated circuits H01L 27/00; two-terminal components with a potential-jump or surface barrier H01L 29/00; resistors in general H01C; inductors in general H01F; capacitors in general H01G)}

{Inductors}

{Resistors}

{with an active material comprising carbon, e.g. diamond or diamond-like carbon [DLC]}

{with an active material comprising a refractory, transition or noble metal, metal compound or metal alloy, e.g. silicides, oxides, nitrides}

{with an active material comprising an organic conducting material, e.g. conducting polymers}

{Capacitors}

{with a dielectric comprising a perovskite structure material}

{the dielectric comprising two or more layers, e.g. comprising buffer layers, seed layers, gradient layers}

{comprising a barrier layer to prevent diffusion of hydrogen or oxygen}

{Electrodes}

{comprising a noble metal or a noble metal oxide, e.g. platinum (Pt), ruthenium (Ru), ruthenium dioxide (RuO₂), iridium (Ir), iridium dioxide (IrO₂)}

{comprising two or more layers, e.g. comprising a barrier layer and a metal layer}

{with an enlarged surface, e.g. formed by texturisation}

{being a rough surface, e.g. using hemispherical grains}

{having horizontal extensions}

{made by depositing layers, e.g. by depositing alternating conductive and insulating layers}

{made by patterning layers, e.g. by etching conductive layers}

{having vertical extensions}
Semiconductor devices adapted for rectifying, amplifying, oscillating or switching, or capacitors or resistors with at least one potential-jump barrier or surface barrier, e.g. PN junction depletion layer or carrier concentration layer; Details of semiconductor bodies or of electrodes thereof; [Multistep manufacturing processes therefor] (H01L 31/00 - H01L 47/00, H01L 51/05 take precedence; processes or apparatus adapted for the manufacture or treatment thereof or of parts thereof H01L 21/00; details other than of semiconductor bodies or of electrodes thereof H01L 23/00; devices consisting of a plurality of solid state components formed in or on a common substrate H01L 27/00; passive two-terminal components without a potential-jump or surface barrier for integrated circuits, details thereof and multistep manufacturing processes therefor H01L 28/00; ) resistors in general H01C manufacturing processes therefor H01L 29/02, groups H01L 29/02

NOTE
In this main group, classification is made both in groups H01L 29/02 - H01L 29/51 and in groups H01L 29/66 - H01L 29/94 if both of these sets of groups are relevant.

29/02 . Semiconductor bodies [: Multistep manufacturing processes therefor]
29/04 . . characterised by their crystalline structure, e.g. polycrystalline, cubic or particular orientation of crystalline planes (characterised by physical imperfections H01L 29/30)
29/045 . . [by their particular orientation of crystalline planes]
29/06 . . characterised by their shape; characterised by the shapes, relative sizes, or dispositions of the semiconductor regions [: characterised by the concentration or distribution of impurities within semiconductor regions]
29/0603 . . [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 H01L 21/76; design considerations for integrated circuits H01L 27/00; geometrical design considerations for devices H01L 29/0657)]
29/0607 . . . . [for preventing surface leakage or controlling electric field concentration]
29/0611 . . . . [for increasing or controlling the breakdown voltage of reverse biased devices (H01L 29/061 takes precedence)]
29/0615 . . . . . . [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 H01L 29/7833)]
{Non-interconnected multi-emitter structures}

{of heterojunction bipolar transistors (H01L 29/7375 takes precedence)}

{Collector regions of bipolar transistors}

{Pedestal collectors}

{Anode or cathode regions of thyristors or gated bipolar-mode devices}

{Anode regions of thyristors or gated bipolar-mode devices, e.g. supplementary regions surrounding anode regions}

{Cathode regions of thyristors}

{Source or drain regions of field-effect devices}

{of field-effect transistors with insulated gate (H01L 29/0653 takes precedence; with a passive supplementary region between source or drain and substrate related to punch-through, capacity or isolation phenomena H01L 29/1079; with LDD or DDD structure H01L 29/7833; for thin film transistors H01L 29/78618)}

{of DMOS transistors}

**WARNING**

Groups H01L 29/0852 – H01L 29/0856 are incomplete pending reclassification of documents from group H01L 29/0887 and H01L 29/7801.

Groups H01L 29/0852 – H01L 29/0886 and H01L 29/0847, H01L 29/7801 should be considered in order to perform a complete search.

{Source regions}

{Disposition}

{Shape (cell layout H01L 29/0696)}

{Drain regions}

{Impurity concentration or distribution}

{Disposition}

{Shape}

{of field-effect transistors with Schottky gate}

{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}

{Base region of bipolar transistors}

{of lateral transistors}

{Base regions of thyristors (H01L 29/083 takes precedence)}

{Anode base regions of thyristors}

{Cathode base regions of thyristors}

{Channel region of field-effect devices}

{of field-effect transistors}

{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 H01L 29/42376; with buried channel H01L 29/7838)}

{and non-planar channel (resulting from the gate electrode disposition, e.g. within a trench, H01L 29/42356)}

{with a non-uniform doping structure in the channel region surface}

{the doping structure being parallel to the channel length, e.g. DMOS like}

{with vertical doping variation (H01L 29/7801 takes precedence)}

{with a variation of the composition, e.g. channel with strained layer for increasing the mobility}

{with PN junction gate}

{of charge coupled devices}

{Gate region of field-effect devices with PN junction gate}

{Substrate region of field-effect devices}

{of field-effect transistors}

{insulated gate}

{with an inactive supplementary region, e.g. for preventing punch-through, improving capacity effect or leakage current}

{characterised by the contact structure of the substrate region, e.g. for controlling or preventing bipolar effect}

{Body region, i.e. base region, of DMOS transistors or IGBTs (cell layout H01L 29/0696)}

characterised by the materials of which they are formed

{Single quantum well structures (single heterojunctions, couples of materials H01L 29/165, H01L 29/205, H01L 29/225, H01L 29/267)}

{Quantum wire structures}

{Quantum box structures}

Structures with periodic or quasi periodic potential variation, e.g. multiple quantum wells, superlattices (such structures applied for the control of light G02F 1/017, applied in semiconductor lasers H01S 5/34)

**NOTE**

Group H01L 29/15 takes precedence over groups H01L 29/16 - H01L 29/26.

{Compositional structures (H01L 29/157 and H01L 29/158 take precedence)}

{with quantum effects only in vertical direction, i.e. layered structures with quantum effects solely resulting from vertical potential variation}
29/154 . . . . . . [comprising at least one long range structurally disordered material, e.g. one-dimensional vertical amorphous superlattices]
29/155 . . . . . . [Comprising only semiconductor materials (H01L 29/154 takes precedence)]
29/157 . . . . . . [Doping structures, e.g. doping superlattices, nipi superlattices (delta doping in general H01L 29/365)]
29/158 . . . . . . [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]]
29/16 . . . including, apart from doping materials or other impurities, only elements of Group IV of the Periodic System
29/1602 . . . . [Diamond]
29/1604 . . . . [Amorphous materials]
29/1606 . . . . [Graphene]
29/1608 . . . . [Silicon carbide]
29/161 . . . . including two or more of the elements provided for in group H01L 29/16 [e.g. alloys (H01L 29/1604 takes precedence)]
29/165 . . . . in different semiconductor regions [e.g. heterojunctions]
29/167 . . . . further characterised by the doping material [(H01L 29/1604 takes precedence)]
29/18 . . . . Selenium or tellurium only, apart from doping materials or other impurities
29/185 . . . . [Amorphous materials]
29/20 . . . . including, apart from doping materials or other impurities, only $A_nB_m$ compounds
29/2003 . . . . [Nitride compounds]
29/2006 . . . . [Amorphous materials]
29/201 . . . . including two or more compounds [e.g. alloys (H01L 29/2006 takes precedence)]
29/205 . . . . in different semiconductor regions [e.g. heterojunctions]
29/207 . . . . further characterised by the doping material [(H01L 29/2006 takes precedence)]
29/22 . . . . including, apart from doping materials or other impurities, only $A_nB_m$ compounds
29/2203 . . . . [Cd X compounds being one element of the 6th group of the Periodic System (H01L 29/2206 takes precedence)]
29/2206 . . . . [Amorphous materials]
29/221 . . . . including two or more compounds [e.g. alloys (H01L 29/2206 takes precedence)]
29/225 . . . . in different semiconductor regions [e.g. heterojunctions]
29/227 . . . . further characterised by the doping material [(H01L 29/2206 takes precedence)]
29/24 . . . . including, apart from doping materials or other impurities, only semiconductor materials not provided for in groups H01L 29/16, H01L 29/18, H01L 29/20, H01L 29/22 (including organic materials H01L 51/00)
29/242 . . . . [A$_n$B$_m$ or A$_n$B$_{m-1}$ compounds, e.g. Cu$_2$O, Cu I (H01L 29/247 takes precedence)]
29/245 . . . . [Pb compounds, e.g. PbO (H01L 29/247 takes precedence)]
29/247 . . . . [Amorphous materials]
29/26 . . . . including, apart from doping materials or other impurities, elements provided for in two or more of the groups H01L 29/16, H01L 29/18, H01L 29/20, H01L 29/22, H01L 29/24 [e.g. alloys]
29/263 . . . . [Amorphous materials]
29/267 . . . . in different semiconductor regions [e.g. heterojunctions (H01L 29/263 takes precedence)]
29/30 . . . . characterised by physical imperfections; having polished or roughened surface
29/32 . . . . the imperfections being within the semiconductor body
29/34 . . . . the imperfections being on the surface
29/36 . . . . characterised by the concentration or distribution of impurities [in the bulk material (within semiconductor regions H01L 29/06)]
29/365 . . . . [Planar doping, e.g. atomic-plane doping, delta-doping]
29/40 . . . . [Electrodes (Multistep manufacturing processes therefor)]
29/401 . . . . [Multistep manufacturing processes]

**WARNING**

Group H01L 29/401 is impacted by reclassification into groups H01L 29/4011, H01L 29/40111, H01L 29/40114 and H01L 29/40117.
Groups H01L 29/401, H01L 29/4011, H01L 29/40111, H01L 29/40114 and H01L 29/40117 should be considered in order to perform a complete search.

29/4011 . . . . [for data storage electrodes]

**WARNING**

Group H01L 29/4011 is incomplete pending reclassification of documents from group H01L 29/401.
Group H01L 29/401 and H01L 29/4011 should be considered in order to perform a complete search.

29/40111 . . . . [the electrodes comprising a layer which is used for its ferroelectric properties]

**WARNING**

Group H01L 29/40111 is incomplete pending reclassification of documents from group H01L 29/401.
Group H01L 29/401 and H01L 29/40111 should be considered in order to perform a complete search.

29/40114 . . . . [the electrodes comprising a conductor-insulator-conductor-insulator-semiconductor structure]

**WARNING**

Group H01L 29/40114 is incomplete pending reclassification of documents from group H01L 29/401.
Group H01L 29/401 and H01L 29/40114 should be considered in order to perform a complete search.
WARNING

Group H01L 29/40117 is incomplete pending reclassification of documents from group H01L 29/401.

Group H01L 29/401 and H01L 29/40117 should be considered in order to perform a complete search.

NOTE

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

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.

NOTE

The sink or via-hole leading to the source or drain region is considered to form part of the source or drain electrode.
H01L

29/4236 . . . . . . {within a trench, e.g. trench gate electrode, groove gate electrode}
29/42364 . . . . . . {characterised by the insulating layer, e.g. thickness or uniformity (H01L 29/42324 and H01L 29/4234 take precedence)}
29/42368 . . . . . . {the thickness being non-uniform}
29/42372 . . . . . . {characterised by the conducting layer, e.g. the length, the sectional shape or the lay-out (H01L 29/42324 takes precedence)}
29/42376 . . . . . . {characterised by the length or the sectional shape}
29/4238 . . . . . . {characterised by the surface layout}
29/42384 . . . . . . {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}
2029/42388 . . . . . . {characterised by the shape of the insulating material}
29/42392 . . . . . . {fully surrounding the channel, e.g. gate-all-around}
29/42396 . . . . . . {for charge coupled devices}
29/43 . . . . . . {Heterojunction gate for field effect devices}
29/435 . . . . . . {Resistive materials for field effect devices, e.g. resistive gate for MOSFET or MESFET}
29/437 . . . . . . {Superconductor materials}
29/45 . . . . . . Ohmic electrodes
29/452 . . . . . . {on AIII-BV compounds}
29/454 . . . . . . {on thin film AIII-BV compounds}
29/456 . . . . . . {on silicon}
29/458 . . . . . . {for thin film silicon, e.g. source or drain electrode}
29/47 . . . . . . Schottky barrier electrodes ({H01L 29/435 takes precedence})
29/475 . . . . . . {on AIII-BV compounds}
29/49 . . . . . . Metal-insulator-semiconductor electrodes, [e.g. gates of MOSFET (H01L 29/433 takes precedence)]

NOTE
This group covers also devices using any other conductor material in place of metal

29/4908 . . . . . . {for thin semiconductor, e.g. gate of TFT}
29/4916 . . . . . . {the conductor material next to the insulator being a silicon layer, e.g. polysilicon doped with boron, phosphorus or nitrogen (H01L 29/4908, H01L 29/4983 take precedence)}
29/4925 . . . . . . {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 H01L 29/4916)}
29/4933 . . . . . . {with a silicid layer contacting the silicon layer, e.g. Polycide gate (with a barrier layer between the silicide and silicon layers H01L 29/4941)}
29/4941 . . . . . . {with a barrier layer between the silicon and the metal or metal silicide upper layer, e.g. Silicide/TiN/PolySilicon}
29/495 . . . . . . {the conductor material next to the insulator being a simple metal, e.g. W, Mo (H01L 29/4908, H01L 29/4983 take precedence)}
29/4958 . . . . . . {with a multiple layer structure}
29/4966 . . . . . . {the conductor material next to the insulator being a composite material, e.g. organic material, TiN, MoSi, (H01L 29/4908, H01L 29/4983 take precedence)}
29/4975 . . . . . . {being a silicide layer, e.g. TiSi2}
29/4983 . . . . . . {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}
29/4991 . . . . . . {comprising an air gap}

WARNING
Group H01L 29/4991 is incomplete pending reclassification of documents from group H01L 29/4983.
Groups H01L 29/4991 and H01L 29/4983 should be considered in order to perform a complete search.

29/51 . . . . . . Insulating materials associated therewith (for MIS structures on thin film semiconductor (H01L 29/4908))
29/511 . . . . . . {with a compositional variation, e.g. multilayer structures (H01L 29/516 takes precedence)}
29/512 . . . . . . {the variation being parallel to the channel plane}
29/513 . . . . . . {the variation being perpendicular to the channel plane}
29/515 . . . . . . {with cavities, e.g. containing a gas}
29/516 . . . . . . {with at least one ferroelectric layer}
29/517 . . . . . . {the insulating material comprising a metallic compound, e.g. metal oxide, metal silicate (H01L 29/518 takes precedence)}
29/518 . . . . . . {the insulating material containing nitrogen, e.g. nitride, oxynitride, nitrogen-doped material}

29/66 . . . . . . Types of semiconductor device {; Multistep manufacturing processes therefor}
29/66007 . . . . {Multistep manufacturing processes}
29/66015 . . . . {of devices having a semiconductor body comprising semiconducting carbon, e.g. diamond, diamond-like carbon, graphene}
29/66022 . . . . {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}
29/6603 . . . . . . {Diodes}
29/66037 . . . . . . {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}
29/66045 . . . . . . [Field-effect transistors]
29/66053 . . . . . . [of devices having a semiconductor body comprising crystalline silicon carbide]
29/6606 . . . . . . [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]
29/66068 . . . . . . [of devices having a semiconductor body comprising group 14 or group 13/15 material (comprising semiconducting carbon H01L 29/66053: comprising crystalline silicon carbide H01L 29/66053)]]
29/66075 . . . . . . [of devices having semiconductors but comprising group 14 or group 13/15 materials (comprising semiconducting carbon H01L 29/66053: comprising crystalline silicon carbide H01L 29/66053)]
29/66083 . . . . . . [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]
29/6609 . . . . . . [Diodes]
29/66098 . . . . . . [Breakdown diodes]
29/66106 . . . . . . [Zener diodes]
29/66113 . . . . . . [Avalanche diodes]
29/66121 . . . . . . [Multilayer diodes, e.g. PNPN diodes]
29/66128 . . . . . . [Planar diodes]
29/66136 . . . . . . [PN junction diodes]
29/66143 . . . . . . [Schottky diodes]
29/66151 . . . . . . [Tunnel diodes (group 13/15 resonant tunneling diodes H01L 29/66219)]
29/66159 . . . . . . [Transit time diodes, e.g. IMPATT, TRAPATT diodes]
29/66166 . . . . . . [Resistors with PN junction]
29/66174 . . . . . . [Capacitors with PN or Schottky junction, e.g. varactors (capacitors with PN junction combined with MOS control H01L 29/66189)]
29/66181 . . . . . . [Conductor-insulator-semiconductor capacitors, e.g. trench capacitors]
29/66189 . . . . . . [with PN junction, e.g. hybrid capacitors]
29/66196 . . . . . . [with an active layer made of a group 13/15 material]
29/66204 . . . . . . [Diodes]
29/66212 . . . . . . [Schottky diodes]
29/66219 . . . . . . [with a heterojunction, e.g. resonant tunneling diodes [RTD]]
29/66227 . . . . . . [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]
29/66234 . . . . . . [Bipolar junction transistors [BJT]]
29/66242 . . . . . . [Heterojunction transistors [HBT] (with an active layer made of a group 13/15 material H01L 29/66318)]
29/6625 . . . . . . [Lateral transistors (H01L 29/66242 and H01L 29/66265 take precedence)]
29/66257 . . . . . . [Schottky transistors]
29/66265 . . . . . . [Thin film bipolar transistors (H01L 29/66242 takes precedence)]
29/66272 . . . . . . [Silicon vertical transistors (H01L 29/66242, H01L 29/66257 and H01L 29/66265 take precedence)]
29/6628 . . . . . . [Inverse transistors]
29/66287 . . . . . . [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 (H01L 29/6628 takes precedence)]
29/66295 . . . . . . [with main current going through the whole silicon substrate, e.g. power bipolar transistor]
29/66303 . . . . . . [with multi-emitter, e.g. interdigitated, multi-cellular or distributed emitter]
29/6631 . . . . . . [with an active layer made of a group 13/15 material]
29/66318 . . . . . . [Heterojunction transistors]
29/66325 . . . . . . [controlled by field-effect, e.g. insulated gate bipolar transistors [IGBT]]
29/66333 . . . . . . [Vertical insulated gate bipolar transistors]
29/6634 . . . . . . [with a recess formed by etching in the source/emitter contact region (H01L 29/66348 takes precedence; etching of semiconductor bodies H01L 21/302)]
29/66348 . . . . . . [with a recessed gate]
29/66356 . . . . . . [Gated diodes, e.g. field controlled diodes [FCD], static induction thyristors [SITh], field controlled thyristors [FCTh]]
29/66363 . . . . . . [Thyristors]
29/66371 . . . . . . [structurally associated with another device, e.g. built-in diode (making integrated circuits H01L 21/821)]
29/66378 . . . . . . [the other device being a controlling field-effect device]
29/66386 . . . . . . [Bidirectional thyristors]
29/66393 . . . . . . [Lateral or planar thyristors]
29/66401 . . . . . . [with an active layer made of a group 13/15 material]
29/66409 . . . . . . [Unipolar field-effect transistors]
29/66416 . . . . . . [Static induction transistors [SIT] (with an active layer made of a group 13/15 material H01L 29/66454)]
29/66424 . . . . . . [Permeable base transistors [PBT]]
29/66431 . . . . . . [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 H01L 29/66462)]
29/66439 . . . . . . [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 H01L 29/66469)]
with an insulated gate, i.e. MISFET

(Static induction transistors [SIT], e.g. permeable base transistors [PBT])

(with a heterojunction interface channel or gate, e.g. HFET, HIGFET, SISFET, HJFET, HEMT)

(with one- or zero-dimensional channel, e.g. quantum wire field-effect transistors, in-plane gate transistors [JPG], single electron transistors [SET], Coulomb blockade transistors, striped channel transistors)

(with an insulated gate, i.e. MISFET)

(with multiple gate, at least one gate being an insulated gate (H01L 29/66742 takes precedence))

(with a pocket or a lightly doped drain selectively formed at the side of the gate)

(using self aligned silicidation, i.e. salicide (formation of conductive layers comprising silicides H01L 21/28518))

(providing different silicidate thicknesses on the gate and on source or drain)

(using self aligned selective metal deposition simultaneously on the gate and on source or drain)

(with an active layer made of a group 13/15 material (H01L 29/66446 takes precedence))

(using the removal of at least part of spacer, e.g. disposable spacer)

(using a self aligned punch through stopper or threshold implant under the gate region (H01L 29/66606 takes precedence))

(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)

(using inside spacers, permanent or not)

(using multiple spacer layers, e.g. multiple sidewall spacers)

(1-Lateral single gate silicon transistors)

(where the source and drain or source and drain extensions are self-aligned to the sides of the gate (H01L 29/66606 takes precedence))

(with initial gate mask or masking layer complementary to the prospective gate location, e.g. with dummy source and drain contacts)

(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)

(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)

(with final source and drain contacts formation strictly before final or dummy gate formation, e.g. contact first technology (H01L 29/66621 takes precedence)

(with a gate recessing step, e.g. using local oxidation (making recessed gate LDMOS transistors H01L 29/66704))

(using etching to form a recess at the gate location (etching of semiconductor bodies H01L 21/302))

(recessing the gate by forming single crystalline semiconductor material at the source or drain location)

(with source or drain recessed by etching or first recessed by etching and then refilled)

(with source or drain regions formed by a Schottky barrier or a conductor-insulator-semiconductor structure)

(with a single crystalline channel formed on the silicon substrate after insulating device isolation)

(with asymmetry in the channel direction, e.g. lateral high-voltage MISFETs with drain offset region, extended drain MISFETs)

(Vertical transistors (H01L 29/66712, H01L 29/66742 take precedence))

(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 H01L 29/6659))

(Lateral DMOS transistors, i.e. LDMOS transistors)

(with a step of forming an insulating sidewall spacer (forming insulating material on a substrate H01L 21/02107))

(with a step of recessing the source electrode)

(with a step of recessing the gate electrode, e.g. to form a trench gate electrode)

(Vertical DMOS transistors, i.e. VDMOS transistors)
[With a step of forming an insulating sidewall spacer] 29/66719
[With a step of recessing the source electrode] 29/66727
[With a step of recessing the gate electrode, e.g. to form a trench gate electrode] 29/66734
[Thin film unipolar transistors] 29/66742
[Amorphous silicon or polysilicon transistors] 29/6675
[Lateral single gate single channel transistors with non-inverted structure, i.e. the channel layer is formed before the gate] 29/66757
[Lateral single gate single channel transistors with inverted structure, i.e. the channel layer is formed after the gate] 29/66765
[Monocrystalline silicon transistors on insulating substrates, e.g. quartz substrates (H01L 29/66646 takes precedence; thin film FinFETs H01L 29/66795)] 29/66772
[on sapphire substrates, e.g. SOS transistors] 29/6678
[with a gate at the side of the channel] 29/66787
[with a horizontal current flow in a vertical sidewall of a semiconductor body, e.g. FinFET, MuGFET] 29/66795
[with a step of doping the vertical sidewall, e.g. using tilted or multi-angled implants] 29/66803
[using dummy structures having essentially the same shape as the semiconductor body, e.g. to provide stability] 29/6681
[the channel being thinned after patterning, e.g. sacrificial oxidation on fin] 29/66818
[with a floating gate (H01L 29/6684 takes precedence)] 29/66825
[with a charge trapping gate insulator, e.g. MNOS transistors] 29/66833
[with a ferroelectric gate insulator] 29/6684
[with a Schottky gate, i.e. MESFET] 29/66848
[with an active layer made of a group 13/15 material (H01L 29/66446 takes precedence)] 29/66856
[Lateral single gate transistors] 29/66863
[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] 29/66871
[Processes wherein the final gate is made before the formation, e.g. activation anneal, of the source and drain regions in the active layer] 29/66878
[Lateral transistors with two or more independent gates] 29/66886
[with a PN junction gate, i.e. JFET] 29/66893
[with a PN homojunction gate] 29/66901
[Vertical transistors, e.g. tecnetrons] 29/66909
[with a PN heterojunction gate] 29/66916
[with an active layer made of a group 13/15 material (H01L 29/66446 takes precedence)] 29/66924
[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]] 29/66931
[with an active layer made of a group 13/15 material] 29/66939
[Charge transfer devices] 29/66946
[with an insulated gate] 29/66954
[with a Schottky gate] 29/66962
[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 H01L 21/02365)] 29/66969
[Quantum effect devices, e.g. using quantum reflection, diffraction or interference effects, i.e. Bragg- or Aharonov-Bohm effects] 29/66977
[Devices using spin polarized carriers] 29/66984
[controllable only by the variation of applied heat (controllable by IR radiation H01L 31/00: measuring quantity of heat G01K 17/000)] 29/66992
[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] 29/68
[Hi-Lo semiconductor devices, e.g. memory devices] 29/685
[Bipolar devices] 29/70
[Double base diodes] 29/705
[Transistor-type devices, i.e. able to continuously respond to applied control signals] 29/72
[Bipolar junction transistors] 29/73
{structurally associated with other devices (assemblies of devices H01L 25/00; integrated circuits H01L 27/000; IGBT H01L 29/7393)} 29/7302
[the device being a resistive element, e.g. ballasting resistor (transistors integrated with resistors H01L 27/075)] 29/7304
[Point contact transistors] 29/7306
[Schottky transistors] 29/7308
[Tunnel transistors] 29/7311
[Avalanche transistors] 29/7313
[Transistors with hook collector] 29/7315
[Bipolar thin film transistors] 29/7317
[Vertical transistors] 29/732
[having emitter-base and base-collector junctions leaving at the same surface of the body, e.g. planar transistor] 29/7322
Thyristor-type devices, e.g. having four-zone regenerative action (two-terminal thyristors \(H01L\ 29/87\))

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

gate IGBT
29/778 . . . . with two-dimensional charge carrier gas channel, e.g. HEMT; [with two-dimensional charge-carrier layer formed at a heterojunction interface (H01L 29/801 takes precedence)]
29/7781 . . . . [with inverted single heterostructure, i.e. with active layer formed on top of wide bandgap layer, e.g. IHEMT]
29/7782 . . . . [with confinement of carriers by at least two heterojunctions, e.g. DHHEMT, quantum well HEMT, DHMODFET]
29/7783 . . . . [using III-V semiconductor material]
29/7784 . . . . [with delta or planar doped donor layer (H01L 29/7785 takes precedence)]
29/7785 . . . . [with more than one donor layer]
29/7786 . . . . [with direct single heterostructure, i.e. with wide bandgap layer formed on top of active layer, e.g. direct single heterostructure MIS-like HEMT]
29/7787 . . . . [with wide bandgap charge-carrier supplying layer, e.g. direct single heterostructure MODFET]
29/7788 . . . . [Vertical transistors]
29/7789 . . . . [the two-dimensional charge carrier gas being at least partially not parallel to a main surface of the semiconductor body]
29/78 . . . . with field effect produced by an insulated gate ((H01L 29/7725, H01L 29/775, H01L 29/778 take precedence))
29/7801 . . . . [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 H01L 29/7835)]
29/7802 . . . . [Vertical DMOS transistors, i.e. VDMOS transistors]
29/7803 . . . . [structurally associated with at least one other device (assemblies H01L 25/00; integrated circuits H01L 27/00)]

**WARNING**

Groups H01L 29/7803 - H01L 29/7808 are incomplete pending reclassification of documents from group H01L 29/7802. Groups H01L 29/7803 and H01L 29/7802 should be considered in order to perform a complete search.

29/7804 . . . . [the other device being a pn-junction diode]
29/7805 . . . . [in antiparallel, e.g. freewheel diode]
29/7806 . . . . [the other device being a Schottky barrier diode]
29/7808 . . . . [the other device being a breakdown diode, e.g. Zener diode]

29/7809 . . . . [having both source and drain contacts on the same surface, i.e. Up-Drain VDMOS transistors]
29/781 . . . . [Inverted VDMOS transistors, i.e. Source-Down VDMOS transistors]
29/7811 . . . . [with an edge termination structure (guard regions per se H01L 29/0619; field plates per se H01L 29/4021)]

**WARNING**

Group H01L 29/7811 is incomplete pending reclassification of documents from group H01L 29/7802. Groups H01L 29/7811 and H01L 29/7802 should be considered in order to perform a complete search.

29/7812 . . . . [with a substrate comprising an insulating layer, e.g. SOI-VDMOS transistors]
29/7813 . . . . [with trench gate electrode, e.g. UMOS transistors (trench gate electrodes per se H01L 29/4236)]
29/7815 . . . . [with voltage or current sensing structure, e.g. emulator section, overcurrent sensing cell]

**WARNING**

Group H01L 29/7815 is incomplete pending reclassification of documents from group H01L 29/7802. Groups H01L 29/7815 and H01L 29/7802 should be considered in order to perform a complete search.

29/7816 . . . . [Lateral DMOS transistors, i.e. LDMOS transistors]
29/7817 . . . . [structurally associated with at least one other device (assemblies H01L 25/00; integrated circuits H01L 27/00)]
29/7818 . . . . [the other device being a pn-junction diode]
29/7819 . . . . [in antiparallel, e.g. freewheel diode]
29/782 . . . . [the other device being a Schottky barrier diode]
29/7821 . . . . [the other device being a breakdown diode, e.g. Zener diode]
29/7823 . . . . [with an edge termination structure (guard regions per se H01L 29/0619; field plates per se H01L 29/4021)]
29/7824 . . . . [with a substrate comprising an insulating layer, e.g. SOI-LDMOS transistors]
29/7825 . . . . [with trench gate electrode (trench gate electrodes per se H01L 29/4236)]
29/7826 . . . . . . . [with voltage or current sensing structure, e.g. emulator section, overcurrent sensing cell]

29/7827 . . . . . . . [Vertical transistors (H01L 29/7802, H01L 29/78642 take precedence)]

29/7828 . . . . . . . [without inversion channel, e.g. vertical ACCUFETs, normally-on vertical MISFETs]

29/783 . . . . . . . [comprising a gate to body connection, i.e. bulk dynamic threshold voltage MOSFET (for thin film transistors H01L 29/78612, H01L 29/78696)]

29/7831 . . . . . . . [with multiple gate structure (FinFETs or MuGFETs H01L 29/7855, thin film transistors H01L 29/78645)]

29/7832 . . . . . . . [the structure comprising a MOS gate and at least one non-MOS gate, e.g. JFET or MISFET gate]

29/7833 . . . . . . . [with lightly doped drain or source extension, e.g. LDD MOSFET's; DDD MOSFET's (for thin film transistors H01L 29/78618)]

29/7834 . . . . . . . [with a non-planar structure, e.g. the gate or the source or the drain being non-planar]

NOTE: Field oxide sunken in the substrate and not filling a groove is not an element characterising a non-planar structure

29/7835 . . . . . . . [with asymmetrical source and drain regions, e.g. lateral high-voltage MISFETs with drain offset region, extended drain MISFETs]

29/7836 . . . . . . . [with a significant overlap between the lightly doped extension and the gate electrode (H01L 29/7834, H01L 29/7835 take precedence)]

29/7838 . . . . . . . [without inversion channel, e.g. buried channel lateral MISFETs, normally-on lateral MISFETs, depletion-mode lateral MISFETs]

29/7839 . . . . . . . [with Schottky drain or source contact]

29/78391 . . . . . . . [the gate comprising a layer which is used for its ferroelectric properties]

29/7841 . . . . . . . [with floating body, e.g. programmable transistors]

29/7842 . . . . . . . [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 H01L 29/1054)]

29/7843 . . . . . . . [the means being an applied insulating layer]

29/7845 . . . . . . . [the means being a conductive material, e.g. silicided S/D or Gate]

29/7846 . . . . . . . [the means being located in the lateral device isolation region, e.g. STI]

29/7847 . . . . . . . [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]

29/7848 . . . . . . . [the means being located in the source/drain region, e.g. SiGe source and drain]

29/7849 . . . . . . . [the means being provided under the channel]

29/785 . . . . . . . [having a channel with a horizontal current flow in a vertical sidewall of a semiconductor body, e.g. FinFET, MuGFET]

29/7851 . . . . . . . [with the body tied to the substrate]

29/7853 . . . . . . . [the body having a non-rectangular crosssection]

29/7854 . . . . . . . [with rounded corners]

29/7855 . . . . . . . [with at least two independent gates]

29/7856 . . . . . . . [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 (H01L 29/7855 takes precedence)]

29/786 . . . . . . . [Thin film transistors, 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 H01L 29/0653; thin film FinFETs H01L 29/785)]

29/78603 . . . . . . . [characterised by the insulating substrate or support (H01L 29/78657 takes precedence)]

29/78606 . . . . . . . [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 (H01L 29/78642, H01L 29/78645 take precedence)]

29/78609 . . . . . . . [for preventing leakage current (H01L 29/78618 takes precedence)]

29/78612 . . . . . . . [for preventing the kink- or the snapback effect, e.g. discharging the minority carriers of the channel region for preventing bipolar effect]

29/78615 . . . . . . . [with a body contact]

29/78618 . . . . . . . [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 H01L 29/458)]

29/78621 . . . . . . . [with LDD structure or an extension or an offset region or characterised by the doping profile]

29/78624 . . . . . . . [the source and the drain regions being asymmetrical]
Aluminium oxide, cadmium stannate, e.g. zinc oxide, copper

comprising an oxide semiconductor

having a semiconductor body

precedence).} 

or alloys including an element of

comprising semiconductor materials

takes precedence).} 

of Group IV not being silicon,

comprising semiconductor materials

takes precedence).} 

Superlattice structure

with a multilayer structure or

amorphous

the semiconducting oxide being

distribution, e.g. graded LDD

transistors having a drain offset

region or a lightly doped drain [LDD]

(29/78612) takes precedence; 

transistors with only two possible levels of programmation (29/78621)

(29/78621)

channel}

with floating gate (19/29/78391

takes precedence)

Programmable transistors with only two possible levels of programmation (29/78621)

Programmable transistors with more than two possible different levels of programmation

Transistors programmable by two single electrons

Vertical transistors, i.e. transistors having source and drain not in the same horizontal plane

with charge trapping gate insulator, e.g.

MNOS-memory transistors

Programmable transistors with more than two possible different levels of programmation

Vertical transistors, i.e. transistors having source and drain not in the same horizontal plane

with field effect produced by a PN or other rectifying junction gate, i.e. potential-jump barrier

Programmable transistors, e.g. with charge-trapping quantum well

with heterojunction gate, e.g.

transistors with semiconductor layer acting as gate insulating layer, MIS-like transistors (29/806) takes precedence; with one dimensional electron gas (29/7775; with dimensional electron gas (29/7778)

Programmable transistors with more than two possible different levels of programmation

Programmable transistors with only two possible levels of programmation

Programmable transistors, e.g. with charge-trapping quantum well

with Schottky drain or source contact

with a PN junction gate, e.g. PN homojunction gate (29/7775, 29/7778, 29/806) takes precedence)

Vertical transistors (SIT (29/7772)

Thin film JFETs)
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; \( \text{H01L} \ 51/42 \) 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, \( \text{H01L} \ 27/00 \); measurement of X-radiation, gamma radiation, corpuscular radiation or cosmic radiation with semiconductor detectors \( \text{G01T} \ 1/24 \), with resistance detectors \( \text{G01T} \ 1/26 \); measurement of neutron radiation with semiconductor detectors \( \text{G01T} \ 3/08 \); couplings of light guides with optoelectronic elements \( \text{G02B} \ 6/42 \); obtaining energy from radioactive sources \( \text{G21H} \).

Details

Arrangements for conducting electric current to or from the device in operations

[for device characterised by at least one potential jump barrier or surface barrier]

[for solar cells or solar cell modules]

[comprising specially adapted module bus-bar structures]

[comprising output lead wires elements]

[Circuit arrangements of general character for the devices]

[for devices characterised by at least one potential jump barrier or surface barrier]

[for solar cells (electrical connection means, e.g. junction boxes, specially adapted for structural association with photovoltaic modules \( \text{H02S} \ 40/34 \)]

[Position sensitive and lateral effect photodetectors; Quadrant photodiodes]

[for devices working in avalanche mode]

[Containers; Encapsulations; for devices comprising output lead wires elements]

[for solar cells or solar cell modules]

[comprising specially adapted module bus-bar structures]

[for solar cells]

[the coatings being antireflective or having enhancing optical properties for the solar cells]

Electrodes

[for devices characterised by at least one potential jump barrier or surface barrier]

[comprising ring electrodes]

[for solar cells]
characterised by their semiconductor bodies

including, apart from doping materials or other impurities, only A VB V compounds, e.g. SiC

characterised by the doping material

including, apart from doping materials or other impurities, only compounds not provided for in groups H01L 31/0322, H01L 31/0324

including only A Bm C vI chalcoprite compounds, e.g. Cu In Se 2, Cu Ga Se 2, Cu In Ga Se 2

characterised by the doping material

including only A V B vI or A B 2 C vI chalcogenide compounds, e.g. Pb Sn Te

characterised by the doping material

including A B 2 C vI D vI kesterite compounds, e.g. Cu ZnSnS e 4, Cu ZnSnS 4

characterised by the doping material

including, apart from doping materials or other impurities, semiconductor materials provided for in two or more of groups H01L 31/0272 - H01L 31/0322, H01L 31/0324

in different semiconductor regions, e.g. Cu X/CdX heterojunctions, X being an element of Group VI of the Periodic System

including only Cu X/CdX heterojunctions, X being an element of Group VI of the Periodic System

characterised by their shape or by the shapes, relative sizes or disposition of the semiconductor regions

comprising a quantum structures

the quantum structure being quantum dots

the quantum structure being quantum wires, or nanorods (carbon nanotubes H01L 51/0048)

Superlattices; Multiple quantum well structures

characterised by amorphous semiconductor layers

including, apart from doping materials or other impurities, only elements of Group IV of the Periodic System, e.g. Si-SiGe superlattices

Doping superlattices, e.g. nipi superlattices

characterised by at least one potential jump barrier or surface barrier

Shape of the body

Shape of the potential jump barrier or surface barrier

characterised by their crystalline structure or particular orientation of the crystalline planes

including polycrystalline semiconductors (H01L 31/0392 takes precedence)

including only elements of Group IV of the Periodic System

including microcrystalline silicon, uc-Si

including microcrystalline A VB V alloys, e.g. uc-SiGe, uc-SiC
31/0376 . . . including amorphous semiconductors
(H01L 31/0392 takes precedence)
31/03762 . . . [including only elements of Group IV of the
Periodic System]
31/03765 . . . {including A_2B_5V compounds or alloys,
e.g. SiGe, SiC}
31/03767 . . . {presenting light-induced characteristic
variations, e.g. Staebler-Wronski effect}
31/0384 . . . including other non-monocrystalline materials,
e.g. semiconductor particles embedded in
an insulating material (H01L 31/0392 takes
precedence)
31/03845 . . . {comprising semiconductor nanoparticles
embedded in a semiconductor matrix (in
insulating matrix H01L 31/0384)}
31/0392 . . . including thin films deposited on metallic or
insulating substrates (; characterised by
specific substrate materials or substrate features
or by the presence of intermediate layers,
e.g. barrier layers, on the substrate (textured
substrates H01L 31/0266)}
31/03921 . . . {including only elements of Group IV of the
Periodic System}
31/03923 . . . {including A_2B_5C_VI compound materials,
e.g. CIS, CIGS}
31/03925 . . . {including A_2B_5QV compound materials, e.g.
CdTe, CdS}
31/03926 . . . {comprising a flexible substrate}
31/03928 . . . {including A_2B_5QV compound, e.g. CIS,
CIGS deposited on metal or polymer foils}
31/04 . adapted as photovoltaic [PV] conversion devices
(testing thereof during manufacture (H01L 22/00);
testing thereof after manufacture H02S 50/10)
31/041 . . Provisions for preventing damage caused by
corpuscular radiation, e.g. for space applications
31/042 . . PV modules or arrays of single PV cells
(supporting structures for PV modules
H02S 20/00)
31/043 . . Mechanically stacked PV cells
31/044 . . including bypass diodes (bypass diodes in the
junction box H02S 40/34)
31/0443 . . comprising bypass diodes integrated or
directly associated with the devices, e.g.
bypass diodes integrated or formed in or on
the same substrates as the photovoltaic cells
31/0445 . . including thin film solar cells, e.g. single thin
film a-Si, CIS or CdTe solar cells
31/046 . . PV modules composed of a plurality of
thin film solar cells deposited on the same
substrate
31/0463 . . characterised by special patterning
methods to connect the PV cells in a
module, e.g. laser cutting of the conductive
or active layers
31/0465 . . comprising particular structures for the
electrical interconnection of adjacent PV
cells in the module (H01L 31/0463 takes
precedence)
31/0468 . . comprising specific means for obtaining
partial light transmission through the
module, e.g. partially transparent thin film
solar modules for windows
31/047 . . . PV cell arrays including PV cells having
multiple vertical junctions or multiple V-
groove junctions formed in a semiconductor
substrate
31/0475 . . . PV cell arrays made by cells in a planar,
e.g. repetitive, configuration on a single
semiconductor substrate; PV cell microarrays
(PV modules composed of a plurality of thin
film solar cells deposited on the same substrate
H01L 31/046)
31/048 . . . Encapsulation of modules
31/0481 . . . [characterised by the composition of the
encapsulation material]
31/0488 . . . {Double glass encapsulation, e.g.
photovoltaic cells arranged between front
and rear glass sheets}
31/049 . . . Protective back sheets
31/05 . . Electrical interconnection means between
PV cells inside the PV module, e.g.
series connection of PV cells (electrodes
H01L 31/0224; electrical interconnection of
thin film solar cells formed on a common
substrate H01L 31/046; particular structures
for electrical interconnecting of adjacent thin
film solar cells in the module H01L 31/0465;
electrical interconnection means specially
adapted for electrically connecting two or more
PV modules H02S 40/36)
31/0504 . . . {specially adapted for series or parallel
connection of solar cells in a module}
31/0508 . . . (the interconnection means having a
particular shape)
31/0512 . . . [made of a particular material or
composition of materials]
31/0516 . . . {specially adapted for interconnection of
back-contact solar cells}
31/052 . . Cooling means directly associated or integrated
with the PV cell, e.g. integrated Peltier elements
for active cooling or heat sinks directly associated
with the PV cells (cooling means in combination
with the PV module H02S 40/42)
31/0521 . . . [using a gaseous or a liquid coolant, e.g. air
flow ventilation, water circulation]
31/0525 . . including means to utilise heat energy directly
associated with the PV cell, e.g. integrated
Seebeck elements
31/053 . . Energy storage means directly associated or
integrated with the PV cell, e.g. a capacitor
integrated with a PV cell (energy storage means
associated with the PV module H02S 40/38)
31/054 . . Optical elements directly associated or integrated
with the PV cell, e.g. light-reflecting means or
light-concentrating means
31/0543 . . . {comprising light concentrating means of the
refractive type, e.g. lenses}
31/0547 . . . {comprising light concentrating means of
the reflecting type, e.g. parabolic mirrors,
concentrators using total internal reflection}
31/0549 . . . {comprising spectrum splitting means, e.g.
dichroic mirrors}
the light-reflecting means being of the back surface reflector [BSR] type
characterised by at least one potential-jump barrier or surface barrier
the potential barriers being of the point-contact type (H01L 31/07 takes precedence)

Barrier or surface barrier, e.g. phototransistors
characterised by at least three potential barriers, e.g. phototransistors
characterised by only one potential barrier or surface barrier
the potential barriers being only of the metal-insulator-semiconductor type
the potential barriers being only of the graded gap type
using electroluminescent element and photocell for light emission H01L 33/00

one potential barrier or surface barrier adapted sources, and electrically or optically coupled light sources, e.g. electroluminescent light a common substrate with, one or more electric structurally associated with, e.g. formed in or on (}); amplifiers being controlled by the light source or sources the semiconductor device sensitive to radiation, all being semiconductor devices { the semiconductor device sensitive to radiation being characterised by at least one potential-jump or surface barrier }

{ the semiconductor sensitive to radiation being characterised by at least one potential-jump or surface barrier }

the light sources and the devices sensitive to radiation all being semiconductor devices characterised by at least one potential or surface barrier

formed in, or on, a common substrate

Processes or apparatus peculiar to the manufacture or treatment of these devices or of parts thereof (not peculiar thereto H01L 21/00)

{ comprising only elements of Group IV of the Periodic System }

{ including only Ge }

{ including only A_{3}B_{5}V alloys, e.g. SiGe }

{ Special manufacturing methods for microcrystalline layers, e.g. uc-SiGe, uc-SiC }

{ Special manufacturing methods for polycrystalline Si, e.g. Si ribbon, poly Si ingots, thin films of polycrystalline Si]

{ Special manufacturing methods for microcrystalline Si, uc-Si ]

{ the active layers comprising only A_{3}B_{3}V compounds, e.g. CdS, ZnS, CdTe }

{ comprising ternary compounds, e.g. Hg Cd Te }

{ comprising a growth substrate not being an A_{3}B_{5}V compound ]

{ the active layers comprising only A_{3}B_{5}V compounds, e.g. GaAs, InP ]

{ comprising ternary or quaternary compounds, e.g. GaAlAs, In Ga As P ]

{ comprising ternary compounds, e.g. Hg Cd Te }  

{ comprising nitride compounds, e.g. InGaN, InGaAlN ]

{ comprising a growth substrate not being an A_{3}B_{5}V compound ]

{ comprising nitride compounds, e.g. GaN ]

{ Particular post-treatment for the devices, e.g. annealing, impurity gettering, short-circuit elimination, recrystallisation ]

{ [ Annealing ]

{ [ Passivation ]

{ [ Recrystallisation ]

{ [ Particular processes or apparatus for batch treatment of the devices ]

{ Apparatus specially adapted for automatic interconnection of solar cells in a module ]

{ Manufacture of transparent electrodes, e.g. TCO, ITO ]

{ methods for etching transparent electrodes ]

{ methods involving the use of temporary, removable substrates ]

{ [ for thin-film semiconductors ]

{ such devices or parts thereof comprising amorphous semiconductor materials ]

{ including only elements of Group IV of the Periodic System ]

{ including A_{3}B_{5}V alloys, e.g. SiGe, SiC ]

{ Particular processes or apparatus for continuous treatment of the devices, e.g. roll-to-roll processes, multi-chamber deposition ]
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 (H01L 51/50 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 H01L 27/15; semiconductor lasers H01S 5/00)

NOTES
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, the first place priority rule is applied, i.e. at each hierarchical level, in the absence of an indication to the contrary, classification is made in the first appropriate place.

33/008 . . . with a plurality of light emitting regions, e.g. laterally discontinuous light emitting layer or photoluminescent region integrated within the semiconductor body (H01L 27/15 takes precedence)

33/10 . . . with a light reflecting structure, e.g. semiconductor Bragg reflector

33/105 . . . {with a resonant cavity structure}

33/12 . . . with a stress relaxation structure, e.g. buffer layer

33/14 . . . with a carrier transport control structure, e.g. highly-doped semiconductor layer or current-blocking structure

33/145 . . . {with a current-blocking structure}

33/16 . . . with a particular crystal structure or orientation, e.g. polycrystalline, amorphous or porous

33/18 . . . within the light emitting region

NOTE
When classifying in this group, classification is also made in group H01L 33/26 or one of its subgroups in order to identify the chemical composition of the light emitting region

33/20 . . . with a particular shape, e.g. curved or truncated substrate

33/22 . . . Roughened surfaces, e.g. at the interface between epitaxial layers

33/24 . . . of the light emitting region, e.g. non-planar junction

33/26 . . . Materials of the light emitting region

33/28 . . . containing only elements of group II and group VI of the periodic system

33/285 . . . {characterised by the doping materials}

33/30 . . . containing only elements of group III and group V of the periodic system

33/305 . . . {characterised by the doping materials}

33/32 . . . containing nitrogen

33/325 . . . {characterised by the doping materials}

33/34 . . . containing only elements of group IV of the periodic system

33/343 . . . {characterised by the doping materials}

33/346 . . . {containing porous silicon}

33/36 . . . characterised by the electrodes

33/38 . . . with a particular shape

33/382 . . . {the electrode extending partially in or entirely through the semiconductor body}

33/385 . . . {the electrode extending at least partially onto a side surface of the semiconductor body}

33/387 . . . {with a plurality of electrode regions in direct contact with the semiconductor body and being electrically interconnected by another electrode layer}

33/40 . . . Materials therefor

33/405 . . . {Reflective materials}

33/42 . . . Transparent materials

33/44 . . . characterised by the coatings, e.g. passivation layer or anti-reflective coating

33/46 . . . Reflective coating, e.g. dielectric Bragg reflector

33/465 . . . {with a resonant cavity structure}
H01L

33/48 . characterised by the semiconductor body packages

**NOTE**
This group covers elements in intimate contact with the semiconductor body or integrated with the package

33/483 . . {Containers}
33/486 . . {adapted for surface mounting}
33/50 . . Wavelength conversion elements
33/501 . . {characterised by the materials, e.g. binder}
33/502 . . {Wavelength conversion materials}
33/504 . . . . . . {Elements with two or more wavelength conversion materials}
33/505 . . {characterised by the shape, e.g. plate or foil}
33/507 . . {the elements being in intimate contact with parts other than the semiconductor body or integrated with parts other than the semiconductor body}
33/508 . . {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}
33/52 . . Encapsulations
33/54 . . having a particular shape
33/56 . . Materials, e.g. epoxy or silicone resin
33/58 . . Optical field-shaping elements
33/60 . . Reflective elements
33/62 . . Arrangements for conducting electric current to or from the semiconductor body, e.g. lead-frames, wire-bonds or solder balls
33/64 . . Heat extraction or cooling elements
33/641 . . {characterized by the materials}
33/642 . . {characterized by the shape}
33/644 . . . . {in intimate contact or integrated with parts of the device other than the semiconductor body}
33/645 . . {the elements being electrically controlled, e.g. Peltier elements}
33/647 . . {the elements conducting electric current to or from the semiconductor body}
33/648 . . {the elements comprising fluids, e.g. heat-pipes}

35/00 Thermoelectric devices comprising a junction of dissimilar materials, i.e. exhibiting Seebeck or Peltier effect with or without other thermoelectric 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 H01L 27/00; refrigerating machines using electric or magnetic effects F25B 21/00; thermometers using thermoelectric or thermomagnetic elements G01K 7/00; obtaining energy from radioactive sources G21H)

35/02 . Details
35/04 . . Structural details of the junction; Connections of leads
35/06 . . . detachable, e.g. using a spring
35/08 . . . non-detachable, e.g. cemented, sintered, soldered, e.g. thin films
35/10 . . . Connections of leads
35/12 . . Selection of the material for the legs of the junction
35/14 . . . using inorganic compositions
35/16 . . . comprising tellurium or selenium or sulfur
35/18 . . . comprising arsenic or antimony or bismuth (H01L 35/16 takes precedence), e.g. A₃InB₇V compounds
35/20 . . . comprising metals only (H01L 35/16, H01L 35/18 take precedence)
35/22 . . . comprising compounds containing boron, carbon, oxygen or nitrogen [or germanium or silicon, e.g. superconductors]
35/225 . . . . . . . . . {Superconducting materials}
35/24 . . . using organic compositions
35/26 . . . using compositions changing continuously or discontinuously inside the material
35/28 . . operating with Peltier or Seebeck effect only
35/30 . . . characterised by the heat-exchanging means at the junction
35/32 . . . characterised by the structure or configuration of the cell or thermoe-couple forming the device (including details about, e.g., housing, insulation, geometry, module)
35/325 . . . . . . . . . {Cascades of thermo-couples}
35/34 . . Processes or apparatus peculiar to the manufacture or treatment of these devices or of parts thereof (not peculiar thereto H01L 21/00)

37/00 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 H01L 27/00; {radiation pyrometers using pyroelectric detectors G01J 5/34} thermometers using thermo-electric or thermomagnetic elements G01K 7/00; selection of materials for magnetography, e.g. for Curie-point writing G03G 5/00)

37/02 . using thermal change of dielectric constant, e.g. working above and below Curie point, e.g. pyroelectric devices)
37/025 . . . {Selection of materials}
37/04 . using thermal change of magnetic permeability, e.g. working above and below the Curie point, e.g. pyromagnetic devices)

39/00 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 H01L 27/00; {light detection GO1J, GO2F 2/00; application to memories G11C 11/44, G11C 15/00, G11C 19/32}; superconducting conductors cables or transmission lines H01B 12/00; {microwaves H01P 7/00, H01P 11/00}; {superconducting coils or windings H01F; amplifiers using superconductivity H03F 19/00; {impulse generators and logic circuits H03K 3/38, H03K 17/92, H03K 19/195; lasers H01S 3/00, H01S 5/00})

**NOTE**
In this group, in the absence of an indication to the contrary, an invention is classified in the last appropriate place
or treatment of devices provided for in H01L 39/00
Processes or apparatus peculiar to the manufacture or treatment thereof or of parts thereof; Details thereof

39/2487 . . . [of devices comprising metal borides, e.g. MgB₂]
39/249 . . . [Treatment of superconductive layers by irradiation, e.g. ion-beam, electron-beam, laser beam, X-rays (irradiation devices G21K H01J)]
39/2493 . . . [for Josephson devices]
39/2496 . . . [comprising high Tc ceramic materials]

41/00 Piezo-electric devices in general; Electrostrictive devices in general; Magnetostriuctive devices in general; Processes or apparatus specially adapted for the manufacture or treatment thereof or of parts thereof; Details thereof

WARNING

Groups H01L 41/23-H01L 41/47 are incomplete pending reclassification of documents from group H01L 41/22.
Groups H01L 41/23-H01L 41/47 and H01L 41/22 should be considered in order to perform a complete search.

40/02 . . . Details
40/04 . . . of piezoelectric or electrostrictive devices
40/042 . . . [Drive or control circuitry or methods for piezoelectric or electrostrictive devices not otherwise provided for]
40/044 . . . [for piezoelectric transformers (conversion of DC or AC power H02M; for operating discharge lamps H05B 41/282)]
40/047 . . . Electrodes [or electrical connection arrangements]
40/0471 . . . [Individual layer electrodes of multilayer piezoelectric or electrostrictive devices, e.g. internal electrodes]
40/0472 . . . [Connection electrodes of multilayer piezoelectric or electrostrictive devices, e.g. external electrodes]
40/0474 . . . [embedded within piezoelectric or electrostrictive material, e.g. via connections]
Piezo-electric or electrostrictive devices with electrical input and electrical output (e.g., networks H03H 9/00 e.g. actuators, vibrators (in frequency selective with electrical input and mechanical output (e.g., having combined actuator and sensor parts) formed as coaxial cables having a stacked or multilayer structure having non-rectangular cross-section in stacking direction, e.g., polygonal, trapezoidal having non-rectangular cross-section orthogonal to the stacking direction, e.g., polygonal, circular) [Annular cross-section] [of cylindrical shape with stacking in radial direction, e.g., coaxial or spiral type rolls] [adapted for alleviating internal stress, e.g., cracking control layers (“Sollbruchstellen”)] [formed as coaxial cables with electrical input and mechanical output (e.g., actuators, vibrators (in frequency selective networks H03H 9/00)) [using longitudinal or thickness displacement combined with bending, shear or torsion displacement] [with polygonal or rectangular shape] [with cylindrical or annular shape] [using bending displacement, e.g., unimorph, bimorph or multimorph cantilever or membrane benders] [Beam type] [Cantilevers, i.e. having one fixed end] [connected at their free ends, e.g., parallelogram type] [with multiple segments mechanically connected in series, e.g. zig-zag type] [adapted for in-plane bending displacement] [adapted for multi-directional bending displacement] [Membrane type] [with non-planar shape] [using longitudinal or thickness displacement only, e.g. d33 or d31 type devices] [using shear or torsion displacement, e.g. d15 type devices] [with electrical input and electrical output (e.g., transformers) with mechanical input and electrical output (e.g., generators, sensors) with mechanical input and electrical output (e.g., generators, sensors) with mechanical input and electrical output (e.g., generators, sensors) Selection of materials for piezo-electric or electrostrictive devices (e.g., bulk piezo-electric crystals) Composite materials, e.g. having 1-3 or 2-2 type connectivity Ceramic compositions (i.e. synthetic inorganic polycrystalline compounds incl. epitaxial, quasi-crystalline materials) Alkaline earth metal based oxides, e.g. barium titanates) Alkaline metal based oxides, e.g. lithium, sodium or potassium niobates Lead based oxides Lead zirconate titanate based Lead based oxides Bismuth based oxides Macromolecular compositions (e.g. piezo-electric polymers for magnetostriuctive devices Processes or apparatus specially adapted for the assembly, manufacture or treatment of piezo-electric or electrostrictive devices or of parts thereof Forming enclosures or casings Assembling devices that include piezo-electric or electrostrictive parts Treating devices or parts thereof to modify a piezo-electric or electrostrictive property, e.g. polariation characteristics, vibration characteristics or mode tuning by polarising Manufacturing multilayered piezo-electric or electrostrictive devices or parts thereof, e.g. by stacking piezo-electric bodies and electrodes by integrally sintering piezo-electric or electrostrictive bodies and electrodes by stacking bulk piezo-electric or electrostrictive bodies and electrodes Forming electrodes, leads or terminal arrangements Connection electrodes of multilayered piezo-electric or electrostrictive parts NOTE: Integral individual layer electrode and connection electrode are classified in both H01L 41/293 and H01L 41/297 Individual layer electrodes of multilayered piezo-electric or electrostrictive parts NOTE: Integral individual layer electrode and connection electrode are classified in both H01L 41/293 and H01L 41/297 Applying piezo-electric or electrostrictive parts or bodies onto an electrical element or another base
a magnetic field

barrier, or surface barrier controllable by variation of
substrate

solid state components formed in or on a common
substrate 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
H01L 27/00; devices using superconductivity
H01L 39/00; piezoelectric devices H01L 41/00; bulk
negative resistance effect devices H01L 47/00;
memories G11C 13/00; G11C 13/0002; amplifying
circuits H03F 11/00; pulse generation H03K 302;
electronic switching circuits H03K 17/00; logic
circuits H03K 19/00))

Processes or apparatus specially adapted for
the assembly, manufacture or treatment of
magnetostrictive devices or of parts thereof

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 H01L 27/00; devices with potential-jump
barrier, or surface barrier, or of parts thereof
controllable by variation of a magnetic field H01L 29/82)

Details

of Hall-effect devices

Hall-effect devices

[Semiconductor Hall-effect devices]

Magnetic-field-controlled resistors

Selection of materials

Processes or apparatus peculiar to the manufacture
or treatment of these devices or of parts thereof (not
peculiar thereto H01L 21/00)

for Hall-effect devices

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 H01L 27/00; devices using superconductivity
H01L 39/00; piezoelectric devices H01L 41/00; bulk
negative resistance effect devices H01L 47/00;
memories G11C 13/00; G11C 13/0002; amplifying
circuits H03F 11/00; pulse generation H03K 302;
electronic switching circuits H03K 17/00; logic
circuits H03K 19/00))

Details

Three or more terminal devices, e.g. transistor
like devices

Radiation or particle beam assisted switching
devices, e.g. optically controlled devices

Device geometry

adapted for essentially horizontal current
flow, e.g. bridge type devices

adapted for essentially vertical current
flow, e.g. sandwich or pillar type devices

on sidewalls of dielectric structures, e.g.
mesa or cup type devices

Further means within the switching
material region to limit current flow, e.g. constrictions

[Electrodes]

[adapted for resistive heating]

[adapted for supplying ionic species]

[adapted for electric field or current
focusing, e.g. tip shaped]

[Thermal details]

[Heating or cooling means other than
resistive heating electrodes, e.g. heater in
parallel]

[Thermal insulation means]

[Selection of switching materials]

[Compounds of sulfur, selenium or tellurium,
e.g. chalcogenides]

[Sulfides, e.g. CuS]

[Selenides, e.g. GeSe]

[Tellurides, e.g. GeSbTe]

[Oxides or nitrides]

[Binary metal oxides, e.g. TaOx]
45/147 . . . . [Complex metal oxides, e.g. perovskites, spinels]
45/148 . . . . [Other compounds of groups 13-15, e.g. elemental or compound semiconductors]
45/149 . . . . [Carbon or carbides]
45/16 . . . . [Manufacturing]
45/1608 . . . . [Formation of the switching material, e.g. layer deposition]
45/1616 . . . . [by chemical vapor deposition, e.g. MOCVD, ALD]
45/1625 . . . . [by physical vapor deposition, e.g. sputtering]
45/1633 . . . . [by conversion of electrode material, e.g. oxidation]
45/1641 . . . . [Modification of the switching material, e.g. post-treatment, doping]
45/165 . . . . [by implantation]
45/1658 . . . . [by diffusion, e.g. photo-dissolution]
45/1666 . . . . [Patterning of the switching material]
45/1675 . . . . [by etching of pre-deposited switching material layers, e.g. lithography]
45/1683 . . . . [by filling of openings, e.g. damascene method]
45/1691 . . . . [Patterning process specially adapted for achieving sub-lithographic dimensions, e.g. using spacers]

47/00 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 H01L 27/00)
47/005 . . [Processes or apparatus peculiar to the manufacture or treatment of these devices or of parts thereof (not peculiar thereto H01L 21/00)]
47/02 . . . . . Gunn-effect devices [or transferred electron devices]
47/023 . . . . . [controlled by electromagnetic radiation]
47/026 . . . . . [Gunn diodes (H01L 47/02 takes precedence)]

49/00 Solid state devices not provided for in groups H01L 27/00 . H01L 47/00 and H01L 51/00 and not provided for in any other subclass; Processes or apparatus peculiar to the manufacture or treatment thereof or of parts thereof
49/003 . . . . [Devices using Mott metal-insulator transition, e.g. field effect transistors]
49/006 . . . . [Quantum devices, e.g. Quantum Interference Devices, Metal Single Electron Transistor (using semiconductors in the active part H01L 29/00)]
49/02 . . . . . Thin-film or thick-film devices

51/00 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 H01L 27/28: thermoelectric devices using organic material H01L 35/00, H01L 37/00: piezoelectric, electrostrictive or magnetostrictive elements using organic material H01L 41/00)
51/0001 . . . . [Processes specially adapted for the manufacture or treatment of devices or of parts thereof (multistep processes H01L 51/0098, H01L 51/05, H01L 51/42, H01L 51/50)]
51/0002 . . . . [Deposition of organic semiconductor materials on a substrate]
51/0003 . . . . [using liquid deposition, e.g. spin coating]
51/0004 . . . . [using printing techniques, e.g. ink-jet printing, screen printing]
51/0005 . . . . [ink-jet printing]
51/0006 . . . . [Electrolytic deposition using an external electrical current, e.g. in-situ electropolymerisation]
51/0007 . . . . [characterised by the solvent]
51/0008 . . . . [using physical deposition, e.g. sublimation, sputtering]
51/0009 . . . . [using laser ablation]
51/001 . . . . [Vacuum deposition]
51/0011 . . . . [selective deposition, e.g. using a mask]
51/0012 . . . . [special provisions for the orientation or alignment of the layer to be deposited]
51/0013 . . . . [using non liquid printing techniques, e.g. thermal transfer printing from a donor sheet]
51/0014 . . . . [for changing the shape of the device layer, e.g. patterning]
51/0015 . . . . [by selective transformation of an existing layer]
51/0016 . . . . [lift off techniques]
51/0017 . . . . [etching of an existing layer]
51/0018 . . . . [using photolithographic techniques]
51/0019 . . . . [using printing techniques, e.g. applying the etch liquid using an ink jet printer]
51/002 . . . . . [Making n- or p-doped regions]
51/0021 . . . . [Formation of conductors]
51/0022 . . . . [using printing techniques, e.g. ink jet printing]
51/0023 . . . . [Patterning of conductive layers]
51/0024 . . . . [for forming devices by joining two substrates together, e.g. lamination technique]
51/0025 . . . . [Purification process of the organic semiconductor material]
51/0026 . . . . [Thermal treatment of the active layer, e.g. annealing]
51/0027 . . . . [using coherent electromagnetic radiation, e.g. laser annealing]
51/0028 . . . . [Thermal treatment in the presence of solvent vapors, e.g. solvent annealing]
51/0029 . . . . [Special provisions for controlling the atmosphere during processing (H01L 51/0026 takes precedence)]
51/003 . . . . . [using a temporary substrate]
51/0031 . . . . [Testing, e.g. accelerated lifetime tests of photovoltaic devices]
51/0032 . . . . [Selection of organic semiconductor materials, e.g. organic light sensitive or organic light emitting materials]

**NOTE**
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 H01L 51/00. For the materials see the relevant subclasses. Attention is drawn to the following places:
• organic materials in general C07C, C07D, C07F, C08L,
• organic materials as electrical conductors H01B 1/12,
• organic materials as electrical insulators H01B 3/18

51/0034 . . . (Organic polymers or oligomers (organic macromolecular compounds or compositions per se C08))

51/0035 . . . (comprising aromatic, heteroaromatic, or acrylic chains, e.g. polyaniline (per se C08G 73/026), polyphenylene (per se C08G 61/10), polyphenylene vinylene (per se C08G 61/02))

51/0036 . . . (Heteroaromatic compounds comprising sulfur or selene, e.g. polythiophene (per se C08G 61/126))

51/0037 . . . . (Polyethylene dioxythiophene [PEDOT] and derivatives)

51/0038 . . . . (Poly-phenylenevinylene and derivatives (per se C08G 61/10))

51/0039 . . . . (Polyelectrolytes (per se C08G 61/10))

51/004 . . . . (comprising aliphatic or olefinic chains, e.g. poly N-vinylcarbazol, PVC, PTFE)

51/0041 . . . . (Poly acetylene (per se C08G 61/04, C08F 38/02, C08F 138/02, C08F 238/02) or derivatives)

51/0042 . . . . (poly N-vinylcarbazol and derivatives)

51/0043 . . . . (Copolymers)

51/0044 . . . . (Ladder-type polymers)

51/0045 . . . . (Carbon containing materials, e.g. carbon nanotubes, fullerenes (per se C01B 32/15))

51/0046 . . . . (Fullerenes, e.g. C_{60}, C_{70})

51/0047 . . . . (comprising substituents, e.g. PCBM)

51/0048 . . . . (Carbon nanotubes)

51/0049 . . . . (comprising substituents)

51/005 . . . . (Macromolecular systems with low molecular weight, e.g. cyanine dyes, coumarine dyes, tetraphiafulvalene (H01L 51/0045, H01L 51/0077, H01L 51/0093, H01L 51/0094, H01L 51/0064 (takced precedence)))

51/0051 . . . . (Charge transfer complexes)

51/0052 . . . . (Polymeric condensed aromatic hydrocarbons, e.g. anthracene)

51/0053 . . . . (Aromatic anhydride or imide compounds, e.g. perylene tetra-carboxylic dianhydride, perylene tetracarboxylic diimide)

51/0054 . . . . (containing four rings, e.g. pyrene)

51/0055 . . . . (containing five rings, e.g. pentacene)

51/0056 . . . . (containing six or more rings)

51/0057 . . . . (containing at least one aromatic ring having 7 or more carbon atoms, e.g. azulene)

51/0058 . . . . (containing more than one polycondensed aromatic rings, e.g. bis-anthracene)

51/0059 . . . . (Amine compounds having at least two aryl rest on at least one amino-nitrogen atom, e.g. triphenylamine (per se C07C 211/00))

51/006 . . . . (comprising polycondensed aromatic hydrocarbons as substituents on the nitrogen atom)

51/0061 . . . . (comprising heteroaromatic hydrocarbons as substituents on the nitrogen atom)

51/0062 . . . . (aromatic compounds comprising a hetero atom, e.g.: N,P,S)

2051/0063 . . . . (Oxadiazole Compounds)

51/0064 . . . . (Cyanine Dyes)

51/0065 . . . . (comprising only oxygen as heteroatom)

51/0067 . . . . (comprising only nitrogen as heteroatom (H01L 51/0064 takes precedence))

51/0068 . . . . (comprising only sulfur as heteroatom)

51/0069 . . . . (comprising two or more different heteroatoms per ring, e.g. S and N (H01L 51/0064 takes precedence))

51/007 . . . . (oxadiazole compounds)

51/0071 . . . . (Polycondensed heteroaromatic hydrocarbons)

51/0072 . . . . (comprising only nitrogen in the heteroaromatic polycondensed ringsystem, e.g. phenanthroline, carbazole)

51/0073 . . . . (comprising only oxygen in the heteroaromatic polycondensed ringsystem, e.g. cumarine dyes)

51/0074 . . . . (comprising only sulfur in the heteroaromatic polycondensed ringsystem, e.g. benzothiophene)

51/0075 . . . . (Langmuir Blodgett films (per se B05D 1/202))

51/0076 . . . . (Liquid crystalline materials (per se C09K 19/00))

51/0077 . . . . (Coordination compounds, e.g. porphyrin)

51/0078 . . . . (Phthalocyanine (per se C09B 47/04))

51/0079 . . . . (Metal complexes comprising a IIIB-metal (B, Al, Ga, In or TI), e.g. Tris (8-hydroxyquinoline) gallium (Ga3))

51/008 . . . . (comprising boron)

51/0081 . . . . (comprising aluminium, e.g. Alq3)

51/0082 . . . . (comprising gallium)

51/0083 . . . . (Metal complexes comprising an iron-series metal, e.g. Fe, Co, Ni)

51/0084 . . . . (Transition metal complexes, e.g. RuII(poly(pyridine complexes)

51/0085 . . . . (comprising Iridium)

51/0086 . . . . (comprising Ruthenium)

51/0087 . . . . (comprising Platinum)

51/0088 . . . . (comprising osmium)

51/0089 . . . . (Metal complexes comprising Lanthanides or Actinides, e.g. Eu)

51/009 . . . . (Polymeric complexes, i.e. complexes having two or more metal centers)

51/0091 . . . . (Metal complexes comprising a IB-metal (Cu, Ag, Au))

51/0092 . . . . (Metal complexes comprising a IIB-metal (Zn, Cd, Hg))

51/0093 . . . . (Biomolecules or bio-macromolecules, e.g. proteins, ATP, chlorophyl, beta-carotene, lipids, enzymes)

51/0094 . . . . (Silicon-containing organic semiconductors)

51/0095 . . . . (Starburst compounds)

51/0096 . . . . (Substrates)

51/0097 . . . . (Flexible substrates)

51/0098 . . . . (Molecular electronic devices (molecular computers G06F 15/80; molecular memories G11C 11/00, G11C 13/02))

51/05 . . . . specially adapted for rectifying, amplifying, oscillating or switching, or capacitors or resistors with at least one potential- jump barrier or surface barrier {multistep processes for their manufacture}
Details of devices

- Oscillated or switched, e.g. two-terminal devices

- Carrying the current to be rectified, amplified, potential applied, to one or more of the electrodes of the electric current supplied or the electric potential

- 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, or switched, e.g. three-terminal devices

- Characterised by the gate dielectric

- The gate dielectric comprising only organic materials

- Comprising organic and inorganic layers

- The gate dielectric comprising composite materials, e.g. TiO₂ particles in a polymer matrix

- Lateral single gate single channel transistors with non inverted structure, i.e. the organic semiconductor layer is formed before the gate electrode

- Lateral single gate single channel transistors with inverted structure, i.e. the organic semiconductor layer is formed after the gate electrode

- Characterised by the gate conductor

- The transistor having two or more gate electrodes

- Characterised by the channel of the transistor

- The channel comprising two or more active layers, e.g. forming pn - hetero-junction

- The channel comprising a composite layer, e.g. a mixture of donor and acceptor moieties, forming pn - bulk hetero-junction

- Having a vertical structure, e.g. vertical carbon nanotube field effect transistors [CNT-FETs]

- 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

- Schottky diodes

- Comprising an organic/organic junction, e.g. hetero-junction

- Comprising an organic/inorganic hetero-junction, e.g. hetero-junction

- Bi-stable switching devices

- Molecular electronic devices [molecular computers G06F 15/80; molecular memories G11C 11/00, G11C 13/02]
Details of devices

{ Carrier blocking layer }
{ Carrier transporting layer }
{ Arrangements for extracting light from the device }
{ having a host comprising an emissive layer }
{ having further additive materials, e.g. for improving the dispersibility, for improving the stabilisation, for assisting energy transfer }
{ Light emitting electrochemicals [LEC], i.e. with mobile ions in the active layer }
{ Multi-colour light emission, e.g. colour tuning, polymer blend, stack of electroluminescent layers }
{ Stack of electroluminescent layers }
{ with spacer layers between the emissive layers }
{ [Carrier transporting layer] }
{ [Doped transporting layer] }
{ [Hole transporting layer] }
{ [comprising a dopant] }
{ [having a multilayered structure] }
{ [arranged between the light emitting layer and the cathode] }
{ [Electron transporting layer] }
{ [comprising a dopant] }
{ [having a multilayered structure] }
{ [arranged between the light emitting layer and the anode] }
{ [Carrier injection layer] }
{ [Electron injection layer] }
{ [Carrier blocking layer] }
{ Details of devices }
{ [Electrodes] }
{ [Anodes, i.e. with high work-function material] }
{ [characterised by the shape] }
{ [combined with auxiliary electrode, e.g. ITO layer combined with metal lines] }
{ [composed of transparent multilayers] }
{ [Reflective anodes, e.g. ITO combined with thick metallic layer] }
{ [Cathodes, i.e. with low work-function material] }
{ [characterised by the shape] }
{ [combined with auxiliary electrodes] }
{ [composed of opaque multilayers] }
{ [Transparent, e.g. including thin metal film] }
{ [Passivation; Containers; Encapsulation, e.g. against humidity] }
{ [Sealing arrangements having a self-supporting structure, e.g. containers] }
{ [the sealing arrangements being made of metallic material] }
{ [characterised by the peripheral sealing arrangement, e.g. adhesives, sealants] }
{ [Vertical spacers, e.g. arranged between the sealing arrangement and the OLED] }
{ [Protective coatings] }
{ [having repetitive multilayer structures] }
{ [including getter material or desiccant] }
{ [Arrangements for extracting light from the device] }
{ [comprising a resonant cavity structure, e.g. Bragg reflector pair] }
Details relating to semiconductor or other solid state devices covered by the group H01L

2223/00 Marks applied to semiconductor devices or parts
2223/544阿拉
2223/54406 .. comprising alphanumeric information
2223/54413 .. comprising digital information, e.g. bar codes, data matrix
2223/5442 .. comprising non digital, non alphanumeric information, e.g. symbols
2223/54426 .. for alignment
2223/54433 .. containing identification or tracking information
2223/5444 .. for electrical read out
2223/54446 .. Wireless electrical read out
2223/54453 .. for use prior to dicing
2223/5446 .. Located in scribe lines
2223/54466 .. Located in a dummy or reference die
2223/54473 .. for use after dicing
2223/5448 .. located on chip prior to dicing and remaining on chip after dicing

2223/54486 .. located on package parts, e.g. encapsulation, leads, package substrate
2223/54493 .. Peripheral marks on wafers, e.g. orientation flats, notches, lot number
2223/58 Structural electrical arrangements for semiconductor devices not otherwise provided for
2223/64 Impedance arrangements
2223/66 High-frequency adaptations
2223/6605 .. High-frequency electrical connections
2223/6611 .. Wire connections
2223/6616 .. Vertical connections, e.g. vias
2223/6622 .. Coaxial feed-throughs in active or passive substrates
2223/6627 .. Waveguides, e.g. microstrip line, strip line, coplanar line
2223/6633 .. Transition between different waveguide types
2223/6638 .. Differential pair signal lines
2223/6644 .. Packaging aspects of high-frequency amplifiers (amplifiers per se H03F)
2223/665 .. Bias feed arrangements
2223/6655 .. Matching arrangements, e.g. arrangement of inductive and capacitive components
2223/6661 .. for passive devices (passive components per se H01L 28/00)
2223/6666 .. for decoupling, e.g. bypass capacitors
2223/6672 .. for integrated passive components, e.g. semiconductor device with passive components only (integrated circuits with passive components only per se H01L 27/01)
2223/6677 .. for antenna, e.g. antenna included within housing of semiconductor device (antennas per se H01Q)
2223/6683 .. for monolithic microwave integrated circuit [MMIC]
2223/6688 .. Mixed frequency adaptations, i.e. for operation at different frequencies
2223/6694 .. Optical signal interface included within high-frequency semiconductor device housing

2224/00 Indexing scheme for arrangements for connecting or disconnecting semiconductor or solid-state bodies and methods related thereto as covered by H01L 24/00

2224/01 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
2224/02 Bonding areas; Manufacturing methods related thereto
2224/0212 Auxiliary members for bonding areas, e.g. spacers
2224/02122 .. being formed on the semiconductor or solid-state body
2224/02123 .. inside the bonding area
2224/02125 .. Reinforcing structures
2224/02126 .. Collar structures
2224/0213 .. Alignment aids
2224/02135 .. Flow barrier
2224/0214 .. Structure of the auxiliary member
2224/02141 .. Multilayer auxiliary member
2224/02145 .. Shape of the auxiliary member
2224/0215 .. Material of the auxiliary member
Manufacturing methods

2224/02163 . . . . . . . on the bonding area
2224/02165 . . . . . . . Reinforcing structures
2224/02166 . . . . . . . Collar structures
2224/0217 . . . . . . . Alignment aids
2224/02175 . . . . . . . Flow barrier
2224/0218 . . . . . . . Structure of the auxiliary member
2224/02181 . . . . . . . Multilayer auxiliary member
2224/02185 . . . . . . . Shape of the auxiliary member
2224/0219 . . . . . . . Material of the auxiliary member
2224/022 . . . . . . . Protective coating, i.e. protective bond-through coating
2224/02205 . . . . . . . Structure of the protective coating
2224/02206 . . . . . . . Multilayer protective coating
2224/0221 . . . . . . . Shape of the protective coating
2224/02215 . . . . . . . Material of the protective coating
2224/02233 . . . . . . . not in direct contact with the bonding area
2224/02235 . . . . . . . Reinforcing structures
2224/0224 . . . . . . . Alignment aids
2224/02245 . . . . . . . Flow barrier
2224/0225 . . . . . . . Structure of the auxiliary member
2224/02251 . . . . . . . Multilayer auxiliary member
2224/02255 . . . . . . . Shape of the auxiliary member
2224/0226 . . . . . . . Material of the auxiliary member
2224/0223 . . . . . . . Redistribution layers (RDL) for bonding areas
2224/0231 . . . . . . . Manufacturing methods of the redistribution layers
2224/02311 . . . . . . . Additive methods
2224/02313 . . . . . . . Subtractive methods
2224/02315 . . . . . . . Self-assembly processes
2224/02317 . . . . . . . by local deposition
2224/02319 . . . . . . . by using a preform
2224/02321 . . . . . . . Reworking
2224/0233 . . . . . . . Structure of the redistribution layers
2224/02331 . . . . . . . Multilayer structure
2224/02333 . . . . . . . being a bump
2224/02335 . . . . . . . Free-standing redistribution layers
2224/0235 . . . . . . . Shape of the redistribution layers
2224/02351 . . . . . . . comprising interlocking features
2224/0236 . . . . . . . Shape of the insulating layers therebetween
2224/0237 . . . . . . . Disposition of the redistribution layers
2224/02371 . . . . . . . connecting the bonding area on a surface of the semiconductor or solid-state body with another surface of the semiconductor or solid-state body
2224/02372 . . . . . . . connecting to a via connection in the semiconductor or solid-state body
2224/02373 . . . . . . . Layout of the redistribution layers
2224/02375 . . . . . . . Top view
2224/02377 . . . . . . . Fan-in arrangement
2224/02379 . . . . . . . Fan-out arrangement
2224/02381 . . . . . . . Side view
2224/0239 . . . . . . . Material of the redistribution layers
2224/024 . . . . . . . Material of the insulating layers therebetween
2224/03 . . . . . . . Manufacturing methods
2224/03001 . . . . . . . Involving a temporary auxiliary member not forming part of the manufacturing apparatus, e.g. removable or sacrificial coating, film or substrate
2224/03002 . . . . . . . for supporting the semiconductor or solid-state body
2224/03003 . . . . . . . for holding or transferring a preform
2224/03005 . . . . . . . for aligning the bonding area, e.g. marks, spacers
2224/03009 . . . . . . . for protecting parts during manufacture
2224/03011 . . . . . . . Involving a permanent auxiliary member, i.e. a member which is left at least partly in the finished device, e.g. coating, dummy feature
2224/03013 . . . . . . . for holding or confining the bonding area, e.g. solder flow barrier
2224/03015 . . . . . . . for aligning the bonding area, e.g. marks, spacers
2224/03019 . . . . . . . for protecting parts during the process
2224/031 . . . . . . . Manufacture and pre-treatment of the bonding area preform
2224/0311 . . . . . . . Shaping
2224/0312 . . . . . . . Applying permanent coating
2224/033 . . . . . . . by local deposition of the material of the bonding area
2224/0331 . . . . . . . in liquid form
2224/03312 . . . . . . . Continuous flow, e.g. using a microsyringe, a pump, a nozzle or extrusion
2224/03318 . . . . . . . by dispensing droplets
2224/0332 . . . . . . . Screen printing, i.e. using a stencil
2224/0333 . . . . . . . in solid form
2224/03332 . . . . . . . using a powder
2224/03334 . . . . . . . using a preform
2224/034 . . . . . . . by blanket deposition of the material of the bonding area
2224/0341 . . . . . . . in liquid form
2224/03416 . . . . . . . Spin coating
2224/03418 . . . . . . . Spray coating
2224/0342 . . . . . . . Curtain coating
2224/03422 . . . . . . . by dipping, e.g. in a solder bath (hot-dipping C23C 2/00)
2224/03424 . . . . . . . Immersion coating, e.g. in a solder bath (immersion processes C23C 2/00)
2224/03426 . . . . . . . Chemical solution deposition [CSD], i.e. using a liquid precursor
2224/03428 . . . . . . . Wave coating
2224/0343 . . . . . . . in solid form
2224/03436 . . . . . . . Lamination of a preform, e.g. foil, sheet or layer
2224/03438 . . . . . . . the preform being at least partly pre-patterned
2224/0344 . . . . . . . by transfer printing
2224/03442 . . . . . . . using a powder
2224/03444 . . . . . . . in gaseous form
2224/0345 . . . . . . . Physical vapour deposition [PVD], e.g. evaporation, or sputtering
2224/03452 . . . . . . . Chemical vapour deposition [CVD], e.g. laser CVD
2224/0346 . . . . . . . Plating
2224/03462 . . . . . . . Electroplating
2224/03464 . . . . . . . Electroless plating
2224/03466 . . . . . . . Conformal deposition, i.e. blanket deposition of a conformal layer on a patterned surface
2224/0347 . . . . . . . using a lift-off mask
2224/03472 . . . . . . . Profile of the lift-off mask
2224/03474 . . . . . . . Multilayer masks
2224/0348 . . . . . . . Permanent masks, i.e. masks left in the finished device, e.g. passivation layers
Bonding areas prior to the connecting process

Structure, shape, material or disposition of the bonding areas on chip-scale packages

Bonding areas specifically adapted for strap connectors

Bonding area integrally formed with a via connection of the semiconductor or solid-state body, e.g.

Bonding areas specifically adapted for a mechanical process, e.g.

Pre-existing or pre-deposited material

Sintering

Anodisation

Curing and solidification, e.g. of a photosensitive material

Self-assembly, e.g. self-agglomeration of the material in a fluid

Auxiliary means therefor, e.g. for self-assembly activation

with special adaptation of the surface of the body to be connected or of an auxiliary substrate, e.g. surface shape specially adapted for the self-assembly process

Selective modification

by patterning a pre-deposited material (treatment of parts prior to assembly of the devices H01L 21/48)

Mechanical treatment, e.g. polishing, grinding

Physical or chemical etching

by physical means only

by chemical means only

Chemical mechanical polishing [CMP]

with selective exposure, development and removal of a photosensitive material, e.g. of a photosensitive conductive resin

Photolithography

using masks

Ablation by means of a laser or focused ion beam [FIB]

involving monitoring, e.g. feedback loop

Post-treatment of the bonding area

Cleaning, e.g. oxide removal step, desmearing

Applying permanent coating, e.g. in-situ coating

Spray coating

by dipping, e.g. in a solder bath

Immersion coating, e.g. in a solder bath

Chemical solution deposition [CSD], i.e. using a liquid precursor

Plating, e.g. electroplating, electroless plating

Physical vapour deposition [PVD], e.g. evaporation, or sputtering

Chemical vapour deposition [CVD], e.g. laser CVD

Applying flux

Applying a precursor material

Reworking, e.g. shaping (reflowing [H01L 2224/03849])

involving a chemical process, e.g. etching the bonding area

involving a mechanical process, e.g. planarising the bonding area

Chemical mechanical polishing [CMP]

Thermal treatments, e.g. annealing, controlled cooling

Reworking

Methods of manufacturing bonding areas involving a specific sequence of method steps

with repetition of the same manufacturing step

Multiple masking steps

using different masks

with modification of the same mask

forming a passivation layer after forming the bonding area

the bump being used as a mask for patterning the bonding area

the bonding area, e.g. under bump metallisation [UBM], being used as a mask for patterning other parts

a passivation layer being used as a mask for patterning the bonding area

specifically adapted to include a probing step

by repairing the bonding area damaged by the probing step

Structure, shape, material or disposition of the bonding areas prior to the connecting process

Bonding areas specifically adapted for bump connectors, e.g. under bump metallisation [UBM]

Bonding areas specifically adapted for layer connectors

Bonding areas specifically adapted for strap connectors

Bonding areas specifically adapted for wire connectors, e.g. wirebond pads

Bonding areas specifically adapted for tape automated bonding [TAB] connectors

Bonding areas specifically adapted for connectors of different types

Bonding areas formed on an encapsulation of the semiconductor or solid-state body, e.g. bonding areas on chip-scale packages

of an individual bonding area

Internal layers

Structure

dual damascene structure

comprising a core and a coating

Bonding area integrally formed with a redistribution layer on the semiconductor or solid-state body, e.g.

Bonding area integrally formed with a via connection of the semiconductor or solid-state body

Shape

comprising apertures or cavities

in top view

being rectangular

being square

being circular or elliptic

in side view

CPC - 2019.08
Material comprising protrusions or indentations
being a conformal layer on a patterned surface
being a non conformal layer on a patterned surface
Disposition
the internal layer being at least partially embedded in the surface
the whole internal layer protruding from the surface
the internal layer being disposed on a redistribution layer on the semiconductor or solid-state body
the internal layer being disposed on a via connection of the semiconductor or solid-state body
the internal layer being disposed in a recess of the surface
the internal layer being disposed in a via connection of the semiconductor or solid-state body
the internal layer extending out of an opening
Single internal layer
Plural internal layers
being mutually engaged together, e.g. through inserts
being disposed next to each other, e.g. side-to-side arrangements
being stacked
Two-layer arrangements
Three-layer arrangements
Four-layer arrangements
with additional elements, e.g. vias, interposed between the stacked layers
Structure of the additional element
being a via with at least a lining layer
Shape of the additional element
Disposition of the additional element
of a single via
at the center of the internal layers
at the periphery of the internal layers
of a plurality of vias
at the center of the internal layers
at the periphery of the internal layers
Uniform arrangement, i.e. array
Random arrangement
Material of the additional element
with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof
the principal constituent melting at a temperature of less than 400°C
the principal constituent melting at a temperature of greater than 1550°C
the principal constituent melting at a temperature of greater than 1100°C and less than 1550°C
Antimony [Sb] as principal constituent
Magnesium [Mg] as principal constituent
Aluminium [Al] as principal constituent
Nickel [Ni] as principal constituent
Cobalt [Co] as principal constituent
Iron [Fe] as principal constituent
Palladium [Pd] as principal constituent
Titanium [Ti] as principal constituent
Platinum [Pt] as principal constituent
Zirconium [Zr] as principal constituent
Chromium [Cr] as principal constituent
Vanadium [V] as principal constituent
Rhodium [Rh] as principal constituent
Ruthenium [Ru] as principal constituent
Iridium [Ir] as principal constituent
Niobium [Nb] as principal constituent
Molybdenum [Mo] as principal constituent
2224/05181 . . . . . . . . . . . Tantalum [Ta] as principal constituent
2224/05183 . . . . . . . . . . . Rhenium [Re] as principal constituent
2224/05184 . . . . . . . . . . . Tungsten [W] as principal constituent
2224/05186 . . . . . . . . . . . with a principal constituent of the material being a non metallic, non metalloid inorganic material
2224/05187 . . . . . . . . . . . Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/05188)
2224/05188 . . . . . . . . . . . Glasses, e.g. amorphous oxides, nitrides or fluorides
2224/0519 . . . . . . . . . . . with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy
2224/05191 . . . . . . . . . . . The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene
2224/05193 . . . . . . . . . . . with a principal constituent of the material being a solid not provided for in groups H01L 2224/051 - H01L 2224/05191, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
2224/05194 . . . . . . . . . . . with a principal constituent of the material being a liquid not provided for in groups H01L 2224/051 - H01L 2224/05191
2224/05195 . . . . . . . . . . . with a principal constituent of the material being a gas not provided for in groups H01L 2224/051 - H01L 2224/05191
2224/05198 . . . . . . . . . . . with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams
2224/05199 . . . . . . . . . . . Material of the matrix
2224/052 . . . . . . . . . . . with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof
2224/05201 . . . . . . . . . . . the principal constituent melting at a temperature of less than 400°C
2224/05205 . . . . . . . . . . . Gallium [Ga] as principal constituent
2224/05209 . . . . . . . . . . . Indium [In] as principal constituent
2224/05211 . . . . . . . . . . . Tin [Sn] as principal constituent
2224/05213 . . . . . . . . . . . Bismuth [Bi] as principal constituent
2224/05214 . . . . . . . . . . . Thallium [Tl] as principal constituent
2224/05216 . . . . . . . . . . . Lead [Pb] as principal constituent
2224/05217 . . . . . . . . . . . the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
2224/05218 . . . . . . . . . . . Zinc [Zn] as principal constituent
2224/0522 . . . . . . . . . . . Antimony [Sb] as principal constituent
2224/05223 . . . . . . . . . . . Magnesium [Mg] as principal constituent
2224/05224 . . . . . . . . . . . Aluminium [Al] as principal constituent
2224/05238 . . . . . . . . . . . the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
2224/05239 . . . . . . . . . . . Silver [Ag] as principal constituent
2224/05244 . . . . . . . . . . . Gold [Au] as principal constituent
2224/05247 . . . . . . . . . . . Copper [Cu] as principal constituent
2224/05249 . . . . . . . . . . . Manganese [Mn] as principal constituent
2224/05255 . . . . . . . . . . . Nickel [Ni] as principal constituent
2224/05257 . . . . . . . . . . . Cobalt [Co] as principal constituent
2224/05258 . . . . . . . . . . . Iron [Fe] as principal constituent
2224/0526 . . . . . . . . . . . the principal constituent melting at a temperature of greater than 1550°C
2224/05263 . . . . . . . . . . . Palladium [Pd] as principal constituent
2224/05266 . . . . . . . . . . . Titanium [Ti] as principal constituent
2224/05269 . . . . . . . . . . . Platinum [Pt] as principal constituent
2224/0527 . . . . . . . . . . . Zirconium [Zr] as principal constituent
2224/05271 . . . . . . . . . . . Chromium [Cr] as principal constituent
2224/05272 . . . . . . . . . . . Vanadium [V] as principal constituent
2224/05273 . . . . . . . . . . . Rhodium [Rh] as principal constituent
2224/05276 . . . . . . . . . . . Ruthenium [Ru] as principal constituent
2224/05278 . . . . . . . . . . . Iridium [Ir] as principal constituent
2224/05279 . . . . . . . . . . . Niobium [Nb] as principal constituent
2224/0528 . . . . . . . . . . . Molybdenum [Mo] as principal constituent
2224/05281 . . . . . . . . . . . Tantalum [Ta] as principal constituent
2224/05283 . . . . . . . . . . . Rhenium [Re] as principal constituent
2224/05284 . . . . . . . . . . . Tungsten [W] as principal constituent
2224/05286 . . . . . . . . . . . with a principal constituent of the material being a non metallic, non metalloid inorganic material
Fillers
Base material

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/05288)

Glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2224/052 - H01L 2224/05291, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/052 - H01L 2224/05291

with a principal constituent of the material being a gas not provided for in groups H01L 2224/052 - H01L 2224/05291

Fillers

with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

the principal constituent melting at a temperature of less than 400°C

Gallium [Ga] as principal constituent

Indium [In] as principal constituent

Tin [Sn] as principal constituent

Bismuth [Bi] as principal constituent

Thallium [Tl] as principal constituent

Lead [Pb] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc [Zn] as principal constituent

Antimony [Sb] as principal constituent

Magnesium [Mg] as principal constituent

Aluminium [Al] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Silver [Ag] as principal constituent

Gold [Au] as principal constituent

Copper [Cu] as principal constituent

Manganese [Mn] as principal constituent

Nickel [Ni] as principal constituent

Cobalt [Co] as principal constituent

Iron [Fe] as principal constituent

the principal constituent melting at a temperature of greater than 1550°C

Palladium [Pd] as principal constituent

Titanium [Ti] as principal constituent

Platinum [Pt] as principal constituent

Zirconium [Zr] as principal constituent

Chromium [Cr] as principal constituent

Vanadium [V] as principal constituent

Rhodium [Rh] as principal constituent

Ruthenium [Ru] as principal constituent

Iridium [Ir] as principal constituent

Niobium [Nb] as principal constituent

Molybdenum [Mo] as principal constituent

Tantalum [Ta] as principal constituent

Rhenium [Re] as principal constituent

Tungsten [W] as principal constituent

with a principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/0538)

Glasses, e.g. amorphous oxides, nitrides or fluorides with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy
Coating material

with a principal constituent of the material being a solid not provided for in groups H01L 2224/0543 - H01L 2224/0549

e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/0543 - H01L 2224/0549

with a principal constituent of the material being a gas not provided for in groups H01L 2224/0543 - H01L 2224/0549

Coating material

with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

the principal constituent melting at a temperature of less than 400°C

Gallium [Ga] as principal constituent

Indium [In] as principal constituent

Tin [Sn] as principal constituent

Bismuth [Bi] as principal constituent

Thallium [Tl] as principal constituent

Lead [Pb] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc [Zn] as principal constituent

Antimony [Sb] as principal constituent

Magnesium [Mg] as principal constituent

Aluminium [Al] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Silver [Ag] as principal constituent

Gold [Au] as principal constituent

Copper [Cu] as principal constituent

Manganese [Mn] as principal constituent

Nickel [Ni] as principal constituent

Cobalt [Co] as principal constituent

Iron [Fe] as principal constituent

the principal constituent melting at a temperature of greater than 1550°C

Palladium [Pd] as principal constituent

Titanium [Ti] as principal constituent

Platinum [Pt] as principal constituent

Zirconium [Zr] as principal constituent

Chromium [Cr] as principal constituent

Vanadium [V] as principal constituent

Rhodium [Rh] as principal constituent

Iridium [Ir] as principal constituent

Niobium [Nb] as principal constituent

Molybdenum [Mo] as principal constituent

Tantalum [Ta] as principal constituent

Rhenium [Re] as principal constituent

Tungsten [W] as principal constituent

with a principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/0548)

Glasses, e.g. amorphous oxides, nitrides or fluorides with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene
Material with a principal constituent of the material being a metal, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof being a hybrid material, e.g. combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Shape or distribution of the fillers

Shape or distribution of the fillers

Internal layer

External layer

Shape

Comprising apertures or cavities

In top view

Being rectangular

Being square

Being circular or elliptic

In side view

Comprising protrusions or indentations

Conformal layer on a patterned surface

Non conformal layer on a patterned surface

Disposition

On the entire surface of the internal layer

On the entire exposed surface of the internal layer

Only on parts of the surface of the internal layer

Only on the bonding interface of the bonding area

Only outside the bonding interface of the bonding area

Both on and outside the bonding interface of the bonding area

The external layer being at least partially embedded in the surface

The whole external layer protruding from the surface

The external layer being disposed on a redistribution layer on the semiconductor or solid-state body

Material with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof being a hybrid material, e.g. combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Material

With a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof being a hybrid material, e.g. combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Material with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof being a hybrid material, e.g. combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Material with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof being a hybrid material, e.g. combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Material with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof being a hybrid material, e.g. combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Material with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof being a hybrid material, e.g. combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Material with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof being a hybrid material, e.g. combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Material with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof being a hybrid material, e.g. combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Material with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof being a hybrid material, e.g. combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Material with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof being a hybrid material, e.g. combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Material with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof being a hybrid material, e.g. combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Material with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof being a hybrid material, e.g. combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Material with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof being a hybrid material, e.g. combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.
the principal constituent melting at a temperature of greater than 1550°C

Palladium [Pd] as principal constituent

Titanium [Ti] as principal constituent

Platinum [Pt] as principal constituent

Zirconium [Zr] as principal constituent

Chromium [Cr] as principal constituent

Vanadium [V] as principal constituent

Rhodium [Rh] as principal constituent

Ruthenium [Ru] as principal constituent

Iridium [Ir] as principal constituent

Niobium [Nb] as principal constituent

Molybdenum [Mo] as principal constituent

Tantalum [Ta] as principal constituent

Rhenium [Re] as principal constituent

Tungsten [W] as principal constituent

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

Material of the matrix

with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

Gallium [Ga] as principal constituent

Indium [In] as principal constituent

Tin [Sn] as principal constituent

Bismuth [Bi] as principal constituent

Thallium [Tl] as principal constituent

Lead [Pb] as principal constituent

the principal constituent melting at a temperature of less than 400°C

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/05688)

Glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2224/056 - H01L 2224/05691, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/056 - H01L 2224/05691

with a principal constituent of the material being a gas not provided for in groups H01L 2224/056 - H01L 2224/05691

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

Material of the matrix

with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

Gallium [Ga] as principal constituent

Indium [In] as principal constituent

Tin [Sn] as principal constituent

Bismuth [Bi] as principal constituent

Thallium [Tl] as principal constituent

Lead [Pb] as principal constituent

the principal constituent melting at a temperature of less than 400°C

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/05688)

Glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2224/056 - H01L 2224/05691, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/056 - H01L 2224/05691

with a principal constituent of the material being a gas not provided for in groups H01L 2224/056 - H01L 2224/05691

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

Material of the matrix

with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

Gallium [Ga] as principal constituent

Indium [In] as principal constituent

Tin [Sn] as principal constituent

Bismuth [Bi] as principal constituent

Thallium [Tl] as principal constituent

Lead [Pb] as principal constituent

the principal constituent melting at a temperature of less than 400°C
Fillers

Base material
Coating material

segmented structures, foams being a hybrid material, e.g. materials in the form of combination of two or more of the material being a gas - H01L 2224/05891
with a principal constituent

nanotubes, diamond e.g. allotropes of carbon, H01L 2224/058
with a principal constituent

with a principal constituent

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene with a principal constituent of the material being a solid not provided for in groups H01L 2224/058 - H01L 2224/05891 e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
with a principal constituent of the material being a liquid not provided for in groups H01L 2224/058 - H01L 2224/05891
with a principal constituent of the material being a gas not provided for in groups H01L 2224/058 - H01L 2224/05891
with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams
Coating material
Chromium [Cr] as principal constituent
Vanadium [V] as principal constituent
Rhodium [Rh] as principal constituent
Ruthenium [Ru] as principal constituent
Iridium [Ir] as principal constituent
Niobium [Nb] as principal constituent
Molybdenum [Mo] as principal constituent
Tantalum [Ta] as principal constituent
Rhenium [Re] as principal constituent
Tungsten [W] as principal constituent
Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/05988)
Glasses, e.g. amorphous oxides, nitrides or fluorides
The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene
with a principal constituent of the material being a solid not provided for in groups H01L 2224/0599 - H01L 2224/05991, e.g. allotropes of carbon, fullerenes, graphite, carbon-nanotubes, diamond
with a principal constituent of the material being a liquid not provided for in groups H01L 2224/0599 - H01L 2224/05991
with a principal constituent of the material being a gas not provided for in groups H01L 2224/0599 - H01L 2224/05991
with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams
Shape or distribution of the fillers
of a plurality of bonding areas
Bonding areas having different sizes, e.g. different heights or widths
Bonding areas having different shapes or distribution of the fillers
Disposition
the bonding areas being at different heights
Layout
Square or rectangular array
being uniform, i.e. having a uniform pitch across the array
being non uniform, i.e. having a non uniform pitch across the array
with a staggered arrangement, e.g. depopulated array
covering only portions of the surface to be connected
Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements
Covering only the central area of the surface to be connected, i.e. central arrangements
with specially adapted redistribution layers [RDL]
being disposed in a single wiring level, i.e. planar layout
being disposed in different wiring levels, i.e. resurf layout
Circular array, i.e. array with radial symmetry
being uniform, i.e. having a uniform pitch across the array
being non uniform, i.e. having a non uniform pitch across the array
with a staggered arrangement, e.g. depopulated array
covering only portions of the surface to be connected
Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements
Covering only the central area of the surface to be connected, i.e. central arrangements
with specially adapted redistribution layers [RDL]
being disposed in a single wiring level, i.e. planar layout
being disposed in different wiring levels, i.e. resurf layout
Mirror array, i.e. array having only a reflection symmetry, i.e. bilateral symmetry
being uniform, i.e. having a uniform pitch across the array
being non uniform, i.e. having a non uniform pitch across the array
with a staggered arrangement, e.g. depopulated array
covering only portions of the surface to be connected
Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements
Covering only the central area of the surface to be connected, i.e. central arrangements
with specially adapted redistribution layers [RDL]
being disposed in a single wiring level, i.e. planar layout
being disposed in different wiring levels, i.e. resurf layout
Covering only the central area of the surface to be connected, i.e. central arrangements

with specially adapted redistribution layers [RDL]

being disposed in a single wiring level, i.e. planar layout

being disposed in different wiring levels, i.e. resurf layout

Random array, i.e. array with no symmetry

with a staggered arrangement

covering only portions of the surface to be connected

Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements

Covering only the central area of the surface to be connected, i.e. central arrangements

with specially adapted redistribution layers [RDL]

being disposed in a single wiring level, i.e. planar layout

being disposed in different wiring levels, i.e. resurf layout

Combinations of arrays with different layouts

Corner adaptations, i.e. disposition of the bonding areas at the corners of the semiconductor or solid-state body

being disposed on at least two different sides of the body, e.g. dual array

On opposite sides of the body

with specially adapted redistribution layers [RDL]

On contiguous sides of the body

with specially adapted redistribution layers [RDL]

being disposed in a single wiring level, i.e. planar layout

being disposed in different wiring levels, i.e. resurf layout

Material

Bonding areas having different materials

Function

Bonding areas having different functions

including bonding areas providing primarily mechanical bonding

including bonding areas providing primarily thermal dissipation

Structure, shape, material or disposition of the bonding areas after the connecting process

of an individual bonding area

in top view

being non uniform along the bonding area

being rectangular

being square

being circular or elliptic

in side view

being non uniform along the bonding area

comprising protrusions or indentations

of bonding interfaces, e.g. interlocking features

Disposition

the bonding area being disposed in a recess of the surface of the body

the bonding area being at least partially embedded in the surface of the body

the whole bonding area protruding from the surface of the body

the bonding area connecting directly to another bonding area, i.e. connectorless bonding, e.g. bumpless bonding

the connected bonding areas being not aligned with respect to each other

the bonding area connecting directly to at least two bonding areas

the bonding area connecting between different semiconductor or solid-state bodies, i.e. chip-to-chip

the bodies being arranged next to each other, e.g. on a common substrate

the bodies being stacked

the bonding area connecting to a via connection in the body

the bonding area connecting to a bonding area disposed in a recess of the surface of the body

the bonding area connecting to a bonding area protruding from the surface of the body

the bonding area connecting between a semiconductor or solid-state body and an item not being a semiconductor or solid-state body, e.g. chip-to-substrate, chip-to-passive

the body and the item being arranged next to each other, e.g. on a common substrate

the item being non-metallic, e.g. being an insulating substrate with or without metallisation

the bonding area connecting to a pin of the item

the bonding area connecting to a potential ring of the item

the bonding area connecting to a via metallisation of the item

the bonding area connecting to a bonding area disposed in a recess of the surface of the item

the bonding area connecting to a bonding area protruding from the surface of the item

the item being metallic

the bonding area connecting to a potential ring of the item
of a plurality of bonding areas having different sizes, e.g. different diameters, heights or widths

the bonding area connecting to a bonding area disposed in a recess of the surface of the item

the bonding area connecting to a bonding area protruding from the surface of the item

the item being a discrete passive component

the bonding area connecting to a bonding area disposed in a recess of the surface of the item

the bonding area connecting to a bonding area protruding from the surface of the item

the body and the item being stacked

the bonding area connecting to a potential ring of the item

the bonding area connecting to a bonding area disposed in a recess of the surface of the item

the bonding area connecting to a bonding area protruding from the surface of the item

the item being metallic

the bonding area connecting to a potential ring of the item

the bonding area connecting to a bonding area disposed in a recess of the surface of the item

the item being a discrete passive component

the bonding area connecting to a bonding area disposed in a recess of the surface of the item

the bonding area connecting to a bonding area protruding from the surface of the item

Material at the bonding interface

comprising an eutectic alloy

comprising an intermetallic compound

outside the bonding interface

of a plurality of bonding areas

Structure

Bonding areas having different sizes, e.g. different diameters, heights or widths

Shape

Bonding areas having different shapes

of their bonding interfaces

Disposition

the bonding areas being at different heights

on the semiconductor or solid-state body

outside the semiconductor or solid-state body

Layout (layout of bonding areas prior to the connecting process H01L 2224/0612)

Square or rectangular array

being non uniform, i.e. having a non uniform pitch across the array

with a staggered arrangement, e.g. depopulated array

covering only portions of the surface to be connected

Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements

Circular array, i.e. array with radial symmetry

being non uniform, i.e. having a non uniform pitch across the array

with a staggered arrangement

covering only portions of the surface to be connected

Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements

Mirror array, i.e. array having only a reflection symmetry, i.e. bilateral symmetry

being uniform, i.e. having a uniform pitch across the array

being non uniform, i.e. having a non uniform pitch across the array

with a staggered arrangement, e.g. depopulated array

covering only portions of the surface to be connected

Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements

Covering only the central area of the surface to be connected, i.e. central arrangements

Random array, i.e. array with no symmetry

with a staggered arrangement

covering only portions of the surface to be connected

Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements

Combinations of arrays with different layouts

Corner adaptations, i.e. disposition of the bonding areas at the corners of the semiconductor or solid-state body
2224/0918 . . . . . . . . . . being disposed on at least two different sides of the body, e.g. dual array
2224/09181 . . . . . . . . . . On opposite sides of the body
2224/09183 . . . . . . . . . . On contiguous sides of the body
2224/095 . . . . . . . . . . . . Material
2224/09505 . . . . . . . . . . Bonding areas having different materials
2224/0951 . . . . . . . . . . . . Function
2224/09515 . . . . . . . . . . Bonding areas having different functions
2224/09517 . . . . . . . . . . including bonding areas providing primarily mechanical support
2224/09519 . . . . . . . . . . including bonding areas providing primarily thermal dissipation
2224/10 . . . . . . . . . . . . Bump connectors; Manufacturing methods related thereto
2224/1012 . . . . . . . . . . Auxiliary members for bump connectors, e.g. spacers
2224/10122 . . . . . . . . . . being formed on the semiconductor or solid-state body to be connected
2224/10125 . . . . . . . . . . Reinforcing structures
2224/10126 . . . . . . . . . . Bump collar
2224/10135 . . . . . . . . . . Alignment aids
2224/10145 . . . . . . . . . . Flow barriers
2224/10152 . . . . . . . . . . being formed on an item to be connected not being a semiconductor or solid-state body
2224/10155 . . . . . . . . . . Reinforcing structures
2224/10156 . . . . . . . . . . Bump collar
2224/10165 . . . . . . . . . . Alignment aids
2224/10175 . . . . . . . . . . Flow barriers
2224/11 . . . . . . . . . . . . Manufacturing methods
2224/11001 . . . . . . . . . . Invoking a temporary auxiliary member not forming part of the manufacturing apparatus, e.g. removable or sacrificial coating, film or substrate
2224/11002 . . . . . . . . . . for supporting the semiconductor or solid-state body
2224/11003 . . . . . . . . . . for holding or transferring the bump preform
2224/11005 . . . . . . . . . . for aligning the bump connector, e.g. marks, spacers
2224/11009 . . . . . . . . . . for protecting parts during manufacture
2224/11011 . . . . . . . . . . Invoking a permanent auxiliary member, i.e. a member which is left at least partly in the finished device, e.g. coating, dummy feature
2224/11013 . . . . . . . . . . for holding or confining the bump connector, e.g. solder flow barrier
2224/11015 . . . . . . . . . . for aligning the bump connector, e.g. marks, spacers
2224/11019 . . . . . . . . . . for protecting parts during the process
2224/111 . . . . . . . . . . . . Manufacture and pre-treatment of the bump connector preform
2224/1111 . . . . . . . . . . Shaping
2224/1112 . . . . . . . . . . Applying permanent coating
2224/113 . . . . . . . . . . . . by local deposition of the material of the bump connector
2224/1131 . . . . . . . . . . in liquid form
2224/11312 . . . . . . . . . . Continuous flow, e.g. using a microsyringe, a pump, a nozzle or extrusion
2224/11318 . . . . . . . . . . by dispensing droplets
2224/1132 . . . . . . . . . . Screen printing, i.e. using a stencil
2224/1133 . . . . . . . . . . in solid form
2224/11332 . . . . . . . . . . using a powder
2224/11334 . . . . . . . . . . using preformed bumps
2224/1134 . . . . . . . . . . Stud bumping, i.e. using a wire-bonding apparatus
2224/114 . . . . . . . . . . . . by blanket deposition of the material of the bump connector
2224/1141 . . . . . . . . . . in liquid form
2224/11416 . . . . . . . . . . Spin coating
2224/11418 . . . . . . . . . . Spray coating
2224/1142 . . . . . . . . . . . . Curtain coating
2224/11422 . . . . . . . . . . by dipping, e.g. in a solder bath (hot-dipping C23C 2/00)
2224/11424 . . . . . . . . . . Immersion coating, e.g. in a solder bath (immersion processes C23C 2/00)
2224/11426 . . . . . . . . . . Chemical solution deposition [CSD], i.e. using a liquid precursor
2224/11428 . . . . . . . . . . Wave coating
2224/1143 . . . . . . . . . . . . in solid form
2224/11436 . . . . . . . . . . Lamination of a preform, e.g. foil, sheet or layer
2224/11438 . . . . . . . . . . the preform being at least partly pre-patterned
2224/1144 . . . . . . . . . . . . by transfer printing
2224/11442 . . . . . . . . . . using a powder
2224/11444 . . . . . . . . . . in gaseous form
2224/1145 . . . . . . . . . . . . Physical vapour deposition [PVD], e.g. evaporation, or sputtering
2224/11452 . . . . . . . . . . Chemical vapour deposition [CVD], e.g. laser CVD
2224/1146 . . . . . . . . . . Plating
2224/11462 . . . . . . . . . . Electroplating
2224/11464 . . . . . . . . . . Electroless plating
2224/11466 . . . . . . . . . . Conformal deposition, i.e. blanket deposition of a conformal layer on a patterned surface
2224/1147 . . . . . . . . . . using a lift-off mask
2224/11472 . . . . . . . . . . Profile of the lift-off mask
2224/11474 . . . . . . . . . . Multilayer masks
2224/1148 . . . . . . . . . . Permanent masks, i.e. masks left in the finished device, e.g. passivation layers
2224/115 . . . . . . . . . . . . by chemical or physical modification of a pre-existing or pre-deposited material
2224/11502 . . . . . . . . . . Pre-existing or pre-deposited material
2224/11505 . . . . . . . . . . Sintering
2224/1151 . . . . . . . . . . Anodisation
2224/11515 . . . . . . . . . . Curing and solidification, e.g. of a photosensitive bump material
2224/1152 . . . . . . . . . . Self-assembly, e.g. self-agglomeration of the bump material in a fluid
2224/11522 . . . . . . . . . . Auxiliary means therefor, e.g. for self-assembly activation
2224/11524 . . . . . . . . . . with special adaptation of the surface or of an auxiliary substrate, e.g. surface shape specially adapted for the self-assembly process
2224/11526 . . . . . . . . . . involving the material of the bonding area, e.g. bonding pad or under bump metallisation [UBM]
2224/1155 . . . . . . . . . . Selective modification
2224/11552 . . . . . . . . . . using a laser or a focussed ion beam [FIB]
2224/11554 . . . . . . . . . . Stereolithography, i.e. solidification of a pattern defined by a laser trace in a photosensitive resin
by patterning a pre-deposited material (treatment of parts prior to assembly of the devices H01L 21/48)

Mechanical treatment, e.g. polishing, grinding

Physical or chemical etching

by physical means only

by chemical means only

Chemical mechanical polishing [CMP]

with selective exposure, development and removal of a photosensitive bump material, e.g. of a photosensitive conductive resin

using masks

Photolithography

using a laser or a focused ion beam [FIB]

Ablation by means of a laser or focused ion beam [FIB]

involving monitoring, e.g. feedback loop

Post-treatment of the bump connector

Cleaning, e.g. oxide removal step, desmearing

Applying permanent coating, e.g. in-situ coating

Spray coating

by dipping, e.g. in a solder bath

Immersion coating, e.g. in a solder bath

Chemical solution deposition [CSD], i.e. using a liquid precursor

Plating, e.g. electroplating, electroless plating

Physical vapour deposition [PVD], e.g. evaporation, or sputtering

Chemical vapour deposition [CVD], e.g. laser CVD

Reworking, e.g. shaping (reflowing H01L 2224/11849)

involving a chemical process, e.g. etching the bump connector

involving a mechanical process, e.g. planarising the bump connector

Chemical mechanical polishing [CMP]

Thermal treatments, e.g. annealing, controlled cooling

Reflowing

Methods of manufacturing bump connectors involving a specific sequence of method steps

with repetition of the same manufacturing step

Multiple masking steps

using different masks

with modification of the same mask

Forming a passivation layer after forming the bump connector

the bump being used as a mask for patterning other parts

the under bump metallisation [UBM] being used as a mask for patterning other parts

a passivation layer being used as a mask for patterning other parts

Structure, shape, material or disposition of the bump connectors prior to the connecting process

Bump connectors formed on an encapsulation of the semiconductor or solid-state body, e.g. bumps on chip-scale packages

of an individual bump connector

Core members of the bump connector

Structure

Bump connector larger than the underlying bonding area, e.g. than the under bump metallisation [UBM]

Bump connector smaller than the underlying bonding area, e.g. than the under bump metallisation [UBM]

Bump connector integrally formed with a redistribution layer on the semiconductor or solid-state body

Bump connector integrally formed with a via connection of the semiconductor or solid-state body

Shape

comprising apertures or cavities, e.g. hollow bump

in top view

being rectangular or square

being circular or elliptic

comprising protrusions or indentations

in side view

being non uniform along the bump connector

comprising protrusions or indentations

at the bonding interface of the bump connector, i.e. on the surface of the bump connector

the bump connector being disposed in a recess of the surface

the bump connector being at least partially embedded in the surface

the whole bump connector protruding from the surface

the bump connector being disposed on a redistribution layer on the semiconductor or solid-state body

the bump connector being disposed on a via connection of the semiconductor or solid-state body

relative to the bonding area, e.g. bond pad, of the semiconductor or solid-state body

the bump connector being offset with respect to the bonding area, e.g. bond pad

the bump connector being disposed on at least two separate bonding areas, e.g. bond pads

Plural core members

being mutually engaged together, e.g. through inserts
Material polonium \([\text{Po}]\), and alloys thereof antimony \([\text{Sb}]\), tellurium \([\text{Te}]\) and \([\text{Si}]\), germanium \([\text{Ge}]\), arsenic \([\text{As}]\), metalloid, e.g. boron \([\text{B}]\), silicon \([\text{Si}]\), with a principal constituent of the material being a metal or a metalloid, e.g. boron \([\text{B}]\), silicon \([\text{Si}]\), germanium \([\text{Ge}]\), arsenic \([\text{As}]\), antimony \([\text{Sb}]\), tellurium \([\text{Te}]\) and polonium \([\text{Po}]\), and alloys thereof the principal constituent melting at a temperature of less than 400°C Gallium \([\text{Ga}]\) as principal constituent Indium \([\text{In}]\) as principal constituent Tin \([\text{Sn}]\) as principal constituent Bismuth \([\text{Bi}]\) as principal constituent Thallium \([\text{Tl}]\) as principal constituent Lead \([\text{Pb}]\) as principal constituent the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C Zinc \([\text{Zn}]\) as principal constituent Antimony \([\text{Sb}]\) as principal constituent Magnesium \([\text{Mg}]\) as principal constituent Aluminium \([\text{Al}]\) as principal constituent the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C Silver \([\text{Ag}]\) as principal constituent Gold \([\text{Au}]\) as principal constituent Copper \([\text{Cu}]\) as principal constituent Manganese \([\text{Mn}]\) as principal constituent Nickel \([\text{Ni}]\) as principal constituent Cobalt \([\text{Co}]\) as principal constituent Iron \([\text{Fe}]\) as principal constituent the principal constituent melting at a temperature of greater than 1550°C Palladium \([\text{Pd}]\) as principal constituent Titanium \([\text{Ti}]\) as principal constituent Platinum \([\text{Pt}]\) as principal constituent Zirconium \([\text{Zr}]\) as principal constituent Chromium \([\text{Cr}]\) as principal constituent Vanadium \([\text{V}]\) as principal constituent Rhodium \([\text{Rh}]\) as principal constituent Ruthenium \([\text{Ru}]\) as principal constituent Iridium \([\text{Ir}]\) as principal constituent Niobium \([\text{Nb}]\) as principal constituent Molybdenum \([\text{Mo}]\) as principal constituent Tantalum \([\text{Ta}]\) as principal constituent Rhenium \([\text{Re}]\) as principal constituent Tungsten \([\text{W}]\) as principal constituent with a principal constituent of the material being a non metallic, non metalloid inorganic material Ceramics, e.g. crystalline carbides, nitriles or oxides (glass ceramics). Glasses, e.g. amorphous oxides, nitriles or fluorides with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene with a principal constituent of the material being a solid not provided for in groups e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond with a principal constituent of the material being a liquid not provided for in groups with a principal constituent of the material being a gas not provided for in groups with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams Material of the matrix with a principal constituent of the material being a metal or a metalloid, e.g. boron \([\text{B}]\), silicon \([\text{Si}]\), germanium \([\text{Ge}]\), arsenic \([\text{As}]\), antimony \([\text{Sb}]\), tellurium \([\text{Te}]\) and polonium \([\text{Po}]\), and alloys thereof
<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2224/13201</td>
<td>the principal constituent melting at a temperature of less than 400°C</td>
</tr>
<tr>
<td>2224/13205</td>
<td>Gallium [Ga] as principal constituent</td>
</tr>
<tr>
<td>2224/13209</td>
<td>Indium [In] as principal constituent</td>
</tr>
<tr>
<td>2224/13211</td>
<td>Tin [Sn] as principal constituent</td>
</tr>
<tr>
<td>2224/13213</td>
<td>Bismuth [Bi] as principal constituent</td>
</tr>
<tr>
<td>2224/13214</td>
<td>Thallium [Tl] as principal constituent</td>
</tr>
<tr>
<td>2224/13216</td>
<td>Lead [Pb] as principal constituent</td>
</tr>
<tr>
<td>2224/13217</td>
<td>the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C</td>
</tr>
<tr>
<td>2224/13218</td>
<td>Zinc [Zn] as principal constituent</td>
</tr>
<tr>
<td>2224/13222</td>
<td>Antimony [Sb] as principal constituent</td>
</tr>
<tr>
<td>2224/13223</td>
<td>Magnesium [Mg] as principal constituent</td>
</tr>
<tr>
<td>2224/13224</td>
<td>Aluminium [Al] as principal constituent</td>
</tr>
<tr>
<td>2224/13238</td>
<td>the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C</td>
</tr>
<tr>
<td>2224/13239</td>
<td>Silver [Ag] as principal constituent</td>
</tr>
<tr>
<td>2224/13244</td>
<td>Gold [Au] as principal constituent</td>
</tr>
<tr>
<td>2224/13247</td>
<td>Copper [Cu] as principal constituent</td>
</tr>
<tr>
<td>2224/13249</td>
<td>Manganese [Mn] as principal constituent</td>
</tr>
<tr>
<td>2224/13255</td>
<td>Nickel [Ni] as principal constituent</td>
</tr>
<tr>
<td>2224/13257</td>
<td>Cobalt [Co] as principal constituent</td>
</tr>
<tr>
<td>2224/1326</td>
<td>Iron [Fe] as principal constituent</td>
</tr>
<tr>
<td>2224/13263</td>
<td>the principal constituent melting at a temperature of greater than 1550°C</td>
</tr>
<tr>
<td>2224/13264</td>
<td>Palladium [Pd] as principal constituent</td>
</tr>
<tr>
<td>2224/13266</td>
<td>Titanium [Ti] as principal constituent</td>
</tr>
<tr>
<td>2224/13269</td>
<td>Platinum [Pt] as principal constituent</td>
</tr>
<tr>
<td>2224/1327</td>
<td>Zirconium [Zr] as principal constituent</td>
</tr>
<tr>
<td>2224/13271</td>
<td>Chromium [Cr] as principal constituent</td>
</tr>
<tr>
<td>2224/13272</td>
<td>Vanadium [V] as principal constituent</td>
</tr>
<tr>
<td>2224/13273</td>
<td>Rhodium [Rh] as principal constituent</td>
</tr>
<tr>
<td>2224/13276</td>
<td>Ruthenium [Ru] as principal constituent</td>
</tr>
<tr>
<td>2224/13278</td>
<td>Iridium [Ir] as principal constituent</td>
</tr>
<tr>
<td>2224/13279</td>
<td>Niobium [Nb] as principal constituent</td>
</tr>
<tr>
<td>2224/1328</td>
<td>Molybdenum [Mo] as principal constituent</td>
</tr>
<tr>
<td>2224/13281</td>
<td>Tantalum [Ta] as principal constituent</td>
</tr>
<tr>
<td>2224/13283</td>
<td>Rhenium [Re] as principal constituent</td>
</tr>
<tr>
<td>2224/13284</td>
<td>Tungsten [W] as principal constituent</td>
</tr>
<tr>
<td>2224/13286</td>
<td>with a principal constituent of the material being a non metallic, non metalloid inorganic material</td>
</tr>
<tr>
<td>2224/13287</td>
<td>Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/13288)</td>
</tr>
<tr>
<td>2224/13288</td>
<td>Glasses, e.g. amorphous oxides, nitrides or fluorides</td>
</tr>
<tr>
<td>2224/13289</td>
<td>with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy</td>
</tr>
<tr>
<td>2224/1329</td>
<td>The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene</td>
</tr>
<tr>
<td>2224/13291</td>
<td>with a principal constituent of the material being a solid not provided for in groups H01L 2224/132 - H01L 2224/13291, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond</td>
</tr>
<tr>
<td>2224/13293</td>
<td>with a principal constituent of the material being a liquid not provided for in groups H01L 2224/132 - H01L 2224/13291</td>
</tr>
<tr>
<td>2224/13294</td>
<td>with a principal constituent of the material being a gas not provided for in groups H01L 2224/132 - H01L 2224/13291</td>
</tr>
<tr>
<td>2224/13295</td>
<td>Fillers</td>
</tr>
<tr>
<td>2224/13298</td>
<td>Base material</td>
</tr>
<tr>
<td>2224/133</td>
<td>with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof</td>
</tr>
<tr>
<td>2224/13301</td>
<td>the principal constituent melting at a temperature of less than 400°C</td>
</tr>
<tr>
<td>2224/13305</td>
<td>Gallium [Ga] as principal constituent</td>
</tr>
<tr>
<td>2224/13309</td>
<td>Indium [In] as principal constituent</td>
</tr>
<tr>
<td>2224/13311</td>
<td>Tin [Sn] as principal constituent</td>
</tr>
<tr>
<td>2224/13313</td>
<td>Bismuth [Bi] as principal constituent</td>
</tr>
<tr>
<td>2224/13314</td>
<td>Thallium [Tl] as principal constituent</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>2224/13316</td>
<td>Lead [Pb] as principal constituent</td>
</tr>
<tr>
<td>2224/13317</td>
<td>Zinc [Zn] as principal constituent</td>
</tr>
<tr>
<td>2224/13318</td>
<td>Antimony [Sb] as principal constituent</td>
</tr>
<tr>
<td>2224/13323</td>
<td>Magnesium [Mg] as principal constituent</td>
</tr>
<tr>
<td>2224/13324</td>
<td>Aluminium [Al] as principal constituent</td>
</tr>
<tr>
<td>2224/13338</td>
<td>Silver [Ag] as principal constituent</td>
</tr>
<tr>
<td>2224/13344</td>
<td>Gold [Au] as principal constituent</td>
</tr>
<tr>
<td>2224/13347</td>
<td>Copper [Cu] as principal constituent</td>
</tr>
<tr>
<td>2224/13349</td>
<td>Manganese [Mn] as principal constituent</td>
</tr>
<tr>
<td>2224/13355</td>
<td>Nickel [Ni] as principal constituent</td>
</tr>
<tr>
<td>2224/13357</td>
<td>Cobalt [Co] as principal constituent</td>
</tr>
<tr>
<td>2224/1336</td>
<td>Iron [Fe] as principal constituent</td>
</tr>
<tr>
<td>2224/13364</td>
<td>Palladium [Pd] as principal constituent</td>
</tr>
<tr>
<td>2224/13366</td>
<td>Titanium [Ti] as principal constituent</td>
</tr>
<tr>
<td>2224/13369</td>
<td>Chromium [Cr] as principal constituent</td>
</tr>
<tr>
<td>2224/1337</td>
<td>Vanadium [V] as principal constituent</td>
</tr>
<tr>
<td>2224/13372</td>
<td>Rhodium [Rh] as principal constituent</td>
</tr>
<tr>
<td>2224/13373</td>
<td>Ruthenium [Ru] as principal constituent</td>
</tr>
<tr>
<td>2224/13376</td>
<td>Iridium [Ir] as principal constituent</td>
</tr>
<tr>
<td>2224/13379</td>
<td>Niobium [Nb] as principal constituent</td>
</tr>
<tr>
<td>2224/1338</td>
<td>Molybdenum [Mo] as principal constituent</td>
</tr>
<tr>
<td>2224/13381</td>
<td>Tantalum [Ta] as principal constituent</td>
</tr>
<tr>
<td>2224/13383</td>
<td>Rhenium [Re] as principal constituent</td>
</tr>
<tr>
<td>2224/13384</td>
<td>Tungsten [W] as principal constituent</td>
</tr>
<tr>
<td>2224/13386</td>
<td>with a principal constituent of the material being a non metallic, non metalloid inorganic material</td>
</tr>
<tr>
<td>2224/13387</td>
<td>Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/13388)</td>
</tr>
<tr>
<td>2224/13388</td>
<td>Glasses, e.g. amorphous oxides, nitrides or fluorides with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy</td>
</tr>
<tr>
<td>2224/1339</td>
<td>with a principal constituent of the material being a solid not provided for in groups H01L 2224/133 - H01L 2224/13391, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond</td>
</tr>
<tr>
<td>2224/13391</td>
<td>with a principal constituent of the material being a liquid not provided for in groups H01L 2224/133 - H01L 2224/13391</td>
</tr>
<tr>
<td>2224/13392</td>
<td>with a principal constituent of the material being a gas not provided for in groups H01L 2224/133 - H01L 2224/13391</td>
</tr>
<tr>
<td>2224/13393</td>
<td>with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams</td>
</tr>
<tr>
<td>2224/13394</td>
<td>Coating material</td>
</tr>
<tr>
<td>2224/13395</td>
<td>with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof</td>
</tr>
<tr>
<td>2224/13396</td>
<td>the principal constituent melting at a temperature of less than 1550°C</td>
</tr>
<tr>
<td>2224/13397</td>
<td>Glasses, e.g. amorphous oxides, nitrides or fluorides with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy</td>
</tr>
<tr>
<td>2224/13398</td>
<td>with a principal constituent of the material being a solid not provided for in groups H01L 2224/133 - H01L 2224/13391, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond</td>
</tr>
<tr>
<td>2224/13399</td>
<td>with a principal constituent of the material being a liquid not provided for in groups H01L 2224/133 - H01L 2224/13391</td>
</tr>
<tr>
<td>2224/134</td>
<td>with a principal constituent of the material being a gas not provided for in groups H01L 2224/133 - H01L 2224/13391</td>
</tr>
<tr>
<td>2224/1340</td>
<td>with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams</td>
</tr>
<tr>
<td>2224/13401</td>
<td>Coating material</td>
</tr>
<tr>
<td>2224/13402</td>
<td>with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof</td>
</tr>
<tr>
<td>2224/13403</td>
<td>the principal constituent melting at a temperature of less than 1550°C</td>
</tr>
</tbody>
</table>
the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc [Zn] as principal constituent

Antimony [Sb] as principal constituent

Magnesium [Mg] as principal constituent

Aluminium [Al] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Silver [Ag] as principal constituent

Gold [Au] as principal constituent

Copper [Cu] as principal constituent

Manganese [Mn] as principal constituent

Nickel [Ni] as principal constituent

Cobalt [Co] as principal constituent

Iron [Fe] as principal constituent

the principal constituent melting at a temperature of greater than 1550°C

Palladium [Pd] as principal constituent

Titanium [Ti] as principal constituent

Platinum [Pt] as principal constituent

Zirconium [Zr] as principal constituent

Chromium [Cr] as principal constituent

Vanadium [V] as principal constituent

Rhodium [Rh] as principal constituent

Ruthenium [Ru] as principal constituent

Iridium [Ir] as principal constituent

Niobium [Nb] as principal constituent

Molybdenum [Mo] as principal constituent

Tantalum [Ta] as principal constituent

Rhenium [Re] as principal constituent

Tungsten [W] as principal constituent

with a principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/13488)

Glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2224/134 - H01L 2224/13491, e.g. allotropes of carbon, fullerene, graphite, carbon nanotubes, diamond

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/134 - H01L 2224/13491

with a principal constituent of the material being a gas not provided for in groups H01L 2224/134 - H01L 2224/13491

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

Shape or distribution of the fillers

Coating

Structure

Shape

being non uniform

comprising protrusions or indentations

at the bonding interface of the bump connector, i.e. on the surface of the bump connector

Disposition

On the entire surface of the core, i.e. integral coating

On the entire exposed surface of the core

Only on parts of the surface of the core, i.e. partial coating

Only on the bonding interface of the bump connector

Only outside the bonding interface of the bump connector

Both on and outside the bonding interface of the bump connector

Single coating layer

Plural coating layers
<table>
<thead>
<tr>
<th>Material of the matrix</th>
<th>Principal Constituent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platinum [Pt] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Palladium [Pd] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Titanium [Ti] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Platinum [Pt] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Material of the matrix</td>
<td>Platinum [Pt] as principal constituent</td>
</tr>
<tr>
<td>Palladium [Pd] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Titanium [Ti] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Platinum [Pt] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Material of the matrix</td>
<td>Zirconium [Zr] as principal constituent</td>
</tr>
<tr>
<td>Chromium [Cr] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Vanadium [V] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Rhodium [Rh] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Ruthenium [Ru] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Iridium [Ir] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Niobium [Nb] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Molybdenum [Mo] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Tantalum [Ta] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Rhenium [Re] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Tungsten [W] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/13688)</td>
<td></td>
</tr>
<tr>
<td>Glasses, e.g. amorphous oxides, nitrides or fluorides</td>
<td></td>
</tr>
<tr>
<td>The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene</td>
<td></td>
</tr>
<tr>
<td>with a principal constituent of the material being a non metallic, non metalloid inorganic material</td>
<td></td>
</tr>
<tr>
<td>with a principal constituent of the material being a solid not provided for in groups H01L 2224/136 - H01L 2224/13691, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond</td>
<td></td>
</tr>
<tr>
<td>with a principal constituent of the material being a liquid not provided for in groups H01L 2224/136 - H01L 2224/13691</td>
<td></td>
</tr>
<tr>
<td>with a principal constituent of the material being a gas not provided for in groups H01L 2224/136 - H01L 2224/13691</td>
<td></td>
</tr>
<tr>
<td>with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams</td>
<td></td>
</tr>
<tr>
<td>Material of the matrix</td>
<td>Material of the matrix</td>
</tr>
<tr>
<td>Platinum [Pt] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Palladium [Pd] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Titanium [Ti] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>Platinum [Pt] as principal constituent</td>
<td></td>
</tr>
<tr>
<td>with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof</td>
<td></td>
</tr>
</tbody>
</table>
the principal constituent melting at a temperature of
less than 400°C
Gallium [Ga] as principal constituent
Indium [In] as principal constituent
Tin [Sn] as principal constituent
Bismuth [Bi] as principal constituent
Thallium [Tl] as principal constituent
Lead [Pb] as principal constituent
the principal constituent melting at a temperature of
greater than or equal to 950°C and less than 1550°C
Zinc [Zn] as principal constituent
Antimony [Sb] as principal constituent
Magnesium [Mg] as principal constituent
Aluminium [Al] as principal constituent
the principal constituent melting at a temperature of
greater than or equal to 950°C and less than 1550°C
Silver [Ag] as principal constituent
Gold [Au] as principal constituent
Copper [Cu] as principal constituent
Manganese [Mn] as principal constituent
Nickel [Ni] as principal constituent
Cobalt [Co] as principal constituent
Iron [Fe] as principal constituent
the principal constituent melting at a temperature of
greater than 1550°C
Palladium [Pd] as principal constituent
Titanium [Ti] as principal constituent
Platinum [Pt] as principal constituent
Zirconium [Zr] as principal constituent
Chromium [Cr] as principal constituent
Vanadium [V] as principal constituent
Rhodium [Rh] as principal constituent
Ruthenium [Ru] as principal constituent
Iridium [Ir] as principal constituent
Niobium [Nb] as principal constituent
Molybdenum [Mo] as principal constituent
Tantalum [Ta] as principal constituent
Rhenium [Re] as principal constituent
Tungsten [W] as principal constituent
with a principal constituent of the material being a non metallic,
non metalloid inorganic material
Ceramics, e.g. crystalline carbides, nitrides or oxides
(glass ceramics H01L 2224/13788)
Glasses, e.g. amorphous oxides, nitrides or fluorides
with a principal constituent of the material being a polymer,
e.g. polyester, phenolic based polymer, epoxy
The principal constituent being an elastomer, e.g. silicones,
isoprene, neoprene
with a principal constituent of the material being a solid
not provided for in groups H01L 2224/13781,
e.g. allotropes of carbon, fullerene, graphite, carbon-
nanotubes, diamond
with a principal constituent of the material being a liquid
not provided for in groups H01L 2224/13781
with a principal constituent of the material being a gas
not provided for in groups H01L 2224/13781
Fillers
Base material
with a principal constituent of the material being a metal
or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge],
arsenic [As], antimony [Sb], tellurium [Te] and polonium
[Po], and alloys thereof
the principal constituent melting at a temperature of
less than 400°C
Gallium [Ga] as principal constituent
Indium [In] as principal constituent
Tin [Sn] as principal constituent
Bismuth [Bi] as principal constituent
Thallium [Tl] as principal constituent
Lead [Pb] as principal constituent with a principal constituent of the material being a nonmetallic, nonmetalloid inorganic material.

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/1388).

Glass, e.g. amorphous oxides, nitrides or fluorides.

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy.

The principal constituent being an elastomer, e.g. silicone, isoprene, neoprene.

with a principal constituent of the material being a solid not provided for in groups H01L 2224/138 - H01L 2224/1391, e.g. allotropes of carbon, fullerene, graphite, carbon nanotubes, diamond.

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/138 - H01L 2224/1391.

with a principal constituent of the material being a gas not provided for in groups H01L 2224/138 - H01L 2224/1391.

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Coating material.

88
greater than 1550°C
melting at a temperature of
the principal constituent
950°C and less than 1550°C
melting at a temperature
of greater than or equal to
of the material being a gas
not provided for in groups
H01L 2224/139 - H01L 2224/13991,
e.g. allotropes of carbon,
fullerene, graphite, carbon-
nanotubes, diamond
with a principal constituent of
the material being a liquid
not provided for in groups
H01L 2224/139 - H01L 2224/13991
with a principal constituent of
the material being a gas
not provided for in groups
H01L 2224/139 - H01L 2224/13991
with a principal constituent of
the material being a solid
not provided for in groups
H01L 2224/139 - H01L 2224/13991
not provided for in groups
of bump connectors
of a plurality of bump connectors
of the surface to be connected
relative to the bonding areas, e.g. bond
pads, of the semiconductor or solid-state body
the bump connectors being bonded to
at least one common bonding area
Function

Material

CPC - 2019.08
the bump connector connecting to a bonding area disposed in a recess of the surface
the bump connector connecting to a bonding area protruding from the surface
the bump connector connecting between a semiconductor or solid-state body and an item not being a semiconductor or solid-state body, e.g. chip-to-substrate, chip-to-passive
the body and the item being arranged next to each other, e.g. on a common substrate
the item being non-metallic, e.g. being an insulating substrate with or without metallisation
the bump connector connecting to a bond pad of the item
the bump connector connecting to a pin of the item
the bump connector connecting to a potential ring of the item
the bump connector connecting to a via metallisation of the item
the bump connector connecting to a bonding area disposed in a recess of the surface of the item
the bump connector connecting to a bonding area protruding from the surface of the item
the bump connector connecting to a bonding area protruding from the surface of the item
the item being metallic
the bump connector connecting to a pin of the item
the bump connector connecting to a bond pad of the item
the item being metallic
the bump connector connecting to a pin of the item
the bump connector connecting to a bond pad of the item
the item being metallic
the bump connector connecting to a pin of the item
the bump connector connecting to a bond pad of the item
the body and the item being stacked
the item being non-metallic, e.g. insulating substrate with or without metallisation
the bump connector connecting to a bond pad of the item
the bump connector connecting to a pin of the item
the bump connector connecting to a potential ring of the item
the bump connector connecting to a via metallisation of the item
the bump connector connecting to a bonding area disposed in a recess of the surface of the item
the bump connector connecting to a bonding area protruding from the surface of the item
the bump connector connecting to a bonding area protruding from the surface of the item
Material
at the bonding interface
comprising an eutectic alloy
comprising an intermetallic compound
outside the bonding interface, e.g. in the bulk of the bump connector
of a plurality of bump connectors
Structure
Bump connectors having different sizes, e.g. different diameters, heights or widths
Shape
Bump connectors having different shapes
of their bonding interfaces
relative to the bonding areas, e.g. bond pads
the bump connectors being bonded to at least one common bonding area
the bump connectors connecting two common bonding areas
Layout (layout of bump connectors prior to the connecting process)
Square or rectangular array
being non uniform, i.e. having a non uniform pitch across the array
with a staggered arrangement, e.g. depopulated array
covering only portions of the surface to be connected
Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements

Covering only the central area of the surface to be connected, i.e. central arrangements

Circular array, i.e. array with radial symmetry

being non uniform, i.e. having a non uniform pitch across the array

with a staggered arrangement

covering only portions of the surface to be connected

Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements

Covering only the central area of the surface to be connected, i.e. central arrangements

Mirror array, i.e. array having only a reflection symmetry, i.e. bilateral symmetry

being uniform, i.e. having a uniform pitch across the array

being non uniform, i.e. having a non uniform pitch across the array

with a staggered arrangement, e.g. depopulated array

covering only portions of the surface to be connected

Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements

Covering only the central area of the surface to be connected, i.e. central arrangements

Random layout, i.e. layout with no symmetry

with a staggered arrangement

covering only portions of the surface to be connected

Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements

Covering only the central area of the surface to be connected, i.e. central arrangements

Combinations of arrays with different layouts

Corner adaptations, i.e. disposition of the bump connectors at the corners of the semiconductor or solid-state body being disposed on at least two different sides of the body, e.g. dual array

On opposite sides of the body

On contiguous sides of the body

Material

Bump connectors having different materials

Function

Bump connectors having different functions

including bump connectors providing primarily mechanical support

including bump connectors providing primarily thermal dissipation

High density interconnect [HDI] connectors; Manufacturing methods related thereto

Manufacturing methods of high density interconnect preforms

Structure, shape, material or disposition of high density interconnect preforms

of an individual HDI interconnect

Structure

Shape

Disposition

Connecting portions

Material

of a plurality of HDI interconnects

Structure

Shape

Connecting portions

Material

HDI interconnects having different materials

Structure, shape, material or disposition of the high density interconnect connectors after the connecting process

of an individual high density interconnect connector

Structure

Deposited, e.g. MCM-D type

Laminated, e.g. MCM-L type

Shape

Conformal with the semiconductor or solid-state device

Disposition

Connecting bonding areas at the same height

Connecting bonding areas at different heights

Connecting within a semiconductor or solid-state body

Connecting between different semiconductor or solid-state bodies, i.e. chip-to-chip

the bodies being arranged next to each other, e.g. on a common substrate

the bodies being arranged on opposite sides of a substrate, e.g. mirror arrangements

the bodies being stacked

the HDI interconnect connecting to the same level of the lower semiconductor or solid-state body at which the upper semiconductor or solid-state body is mounted

the HDI interconnect not connecting to the same level of the lower semiconductor or solid-state body at which the upper semiconductor or solid-state body is mounted, e.g. the upper semiconductor or solid-state body being mounted in a cavity or on a protrusion of the lower semiconductor or solid-state body
2224/24151 . . . . . . . Connecting between a semiconductor or solid-state body and an item not being a semiconductor or solid-state body, e.g. chip-to-substrate, chip-to-passive
2224/24153 . . . . . . . the body and the item being arranged next to each other, e.g. on a common substrate
2224/24155 . . . . . . . the item being non-metallic, e.g. insulating substrate with or without metallisation
2224/24175 . . . . . . . the item being metallic
2224/24195 . . . . . . . the item being a discrete passive component
2224/24221 . . . . . . . the body and the item being stacked
2224/24225 . . . . . . . the item being non-metallic, e.g. insulating substrate with or without metallisation
2224/24226 . . . . . . . the HDI interconnect connecting to the same level of the item at which the semiconductor or solid-state body is mounted, e.g. the item being planar
2224/24227 . . . . . . . the HDI interconnect not connecting to the same level of the item at which the semiconductor or solid-state body is mounted, e.g. the semiconductor or solid-state body being mounted in a cavity or on a protrusion of the item
2224/24245 . . . . . . . the item being metallic
2224/24246 . . . . . . . the HDI interconnect connecting to the same level of the item at which the semiconductor or solid-state body is mounted, e.g. the item being planar
2224/24247 . . . . . . . the HDI interconnect not connecting to the same level of the item at which the semiconductor or solid-state body is mounted, e.g. the semiconductor or solid-state body being mounted in a cavity or on a protrusion of the item
2224/24265 . . . . . . . the item being a discrete passive component
2224/244 . . . . . . . Connecting portions
2224/245 . . . . . . . Material
2224/2499 . . . . . . . Auxiliary members for HDI interconnects, e.g. spacers, alignment aids
2224/24991 . . . . . . . being formed on the semiconductor or solid-state body to be connected
2224/24992 . . . . . . . Flow barrier
2224/24996 . . . . . . . being formed on an item to be connected not being a semiconductor or solid-state body
2224/24997 . . . . . . . Flow barrier
2224/24998 . . . . . . . Reinforcing structures, e.g. ramp-like support
2224/25 . . . . . . . of a plurality of high density interconnect connectors
2224/2501 . . . . . . . Structure
2224/2505 . . . . . . . Shape
2224/251 . . . . . . . Disposition
2224/25105 . . . . . . . Connecting at different heights
by chemical or physical modification of a finished device, e.g. passivation layers

by patterning a pre-deposited material (treatment of parts prior to assembly of the devices H01L 21/48)

Mechanical treatment, e.g. polishing, grinding

Physical or chemical etching

by physical means only

by chemical means only

Chemical mechanical polishing [CMP]
with selective exposure, development and removal of a photosensitive layer material, e.g. of a photosensitive conductive resin

using masks

Photolithography

using a laser or a focused ion beam [FIB]

Ablation by means of a laser or focused ion beam [FIB]

involving monitoring, e.g. feedback loop

Post-treatment of the layer connector

Cleaning, e.g. oxide removal step, desmearing

Applying permanent coating, e.g. in-situ coating

Spray coating

by dipping, e.g. in a solder bath

Immersion coating, e.g. in a solder bath (immersion processes C23C 200)

Chemical solution deposition [CSD], i.e. using a liquid precursor

Electroplating, e.g. electroplating, electroless plating

Physical vapour deposition [PVD], e.g. evaporation, or sputtering

Chemical vapour deposition [CVD], e.g. laser CVD

Conformal deposition, i.e. blanket deposition of a conformal layer on a patterned surface

using a lift-off mask

Profile of the lift-off mask

Multilayer masks

Permanent masks, i.e. masks left in the finished device, e.g. passivation layers

by chemical or physical modification of a pre-existing or pre-deposited material

Pre-existing or pre-deposited material

Sintering

Anodisation

Curing and solidification, e.g. of a photosensitive layer material

Self-assembly, e.g. self-agglomeration of the layer material in a fluid

Auxiliary means therefor, e.g. for self-assembly activation

with special adaptation of the surface or of an auxiliary substrate, e.g. surface shape specially adapted for the self-assembly process

Forming a passivation layer after forming the layer connector
2224/27912 . . . . . . the layer being used as a mask for patterning other parts
2224/27916 . . . . . . a passivation layer being used as a mask for patterning other parts
2224/28 . . . . . . Structure, shape, material or disposition of the layer connectors prior to the connecting process
2224/2810 . . . . . . Layer connectors formed on an encapsulation of the semiconductor or solid-state body, e.g. layer connectors on chip-scale packages
2224/29 . . . . . . of an individual layer connector
2224/29001 . . . . . . Core members of the layer connector
2224/29005 . . . . . . Structure
2224/29006 . . . . . . Layer connector larger than the underlying bonding area
2224/29007 . . . . . . Layer connector smaller than the underlying bonding area
2224/29008 . . . . . . Layer connector integrally formed with a redistribution layer on the semiconductor or solid-state body
2224/29009 . . . . . . Layer connector integrally formed with a via connection of the semiconductor or solid-state body
2224/2901 . . . . . . Shape
2224/2901 . . . . . . comprising apertures or cavities
2224/29012 . . . . . . in top view
2224/29013 . . . . . . being rectangular or square
2224/29014 . . . . . . being circular or elliptic
2224/29015 . . . . . . comprising protrusions or indentations
2224/29016 . . . . . . in side view
2224/29017 . . . . . . being non uniform along the layer connector
2224/29018 . . . . . . comprising protrusions or indentations
2224/29019 . . . . . . at the bonding interface of the layer connector, i.e. on the surface of the layer connector
2224/2902 . . . . . . Disposition
2224/29021 . . . . . . the layer connector being disposed in a recess of the surface (embedded layer connector H01L 2224/29022)
2224/29022 . . . . . . the layer connector being at least partially embedded in the surface
2224/29023 . . . . . . the whole layer connector protruding from the surface
2224/29024 . . . . . . the layer connector being disposed on a redistribution layer on the semiconductor or solid-state body
2224/29025 . . . . . . the layer connector being disposed on a via connection of the semiconductor or solid-state body
2224/29026 . . . . . . relative to the bonding area, e.g. bond pad, of the semiconductor or solid-state body
2224/29027 . . . . . . the layer connector being offset with respect to the bonding area, e.g. bond pad
2224/29028 . . . . . . the layer connector being disposed on at least two separate bonding areas, e.g. bond pads
2224/2903 . . . . . . the layer connector covering only portions of the surface to be connected
2224/29035 . . . . . . covering only the peripheral area of the surface to be connected
2224/29036 . . . . . . covering only the central area of the surface to be connected
2224/29075 . . . . . . Plural core members
2224/29076 . . . . . . being mutually engaged together, e.g. through inserts
2224/29078 . . . . . . being disposed next to each other, e.g. side-to-side arrangements
2224/2908 . . . . . . being stacked
2224/29082 . . . . . . Two-layer arrangements
2224/29083 . . . . . . Three-layer arrangements
2224/29084 . . . . . . Four-layer arrangements
2224/29099 . . . . . . Material
2224/291 . . . . . . with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof
2224/2910 . . . . . . the principal constituent melting at a temperature of less than 400°C
2224/29105 . . . . . . Gallium [Ga] as principal constituent
2224/29109 . . . . . . Indium [In] as principal constituent
2224/2911 . . . . . . Tin [Sn] as principal constituent
2224/29113 . . . . . . Bismuth [Bi] as principal constituent
2224/29114 . . . . . . Thallium [TI] as principal constituent
2224/29116 . . . . . . Lead [Pb] as principal constituent
2224/29117 . . . . . . the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
2224/29118 . . . . . . Zinc [Zn] as principal constituent
2224/2912 . . . . . . Antimony [Sb] as principal constituent
2224/29123 . . . . . . Magnesium [Mg] as principal constituent
2224/29124 . . . . . . Aluminium [Al] as principal constituent
2224/29138 . . . . . . the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
2224/29139 . . . . . . Silver [Ag] as principal constituent
2224/2914 . . . . . . Gold [Au] as principal constituent
2224/29147 . . . . . . Copper [Cu] as principal constituent
2224/29149 . . . . . . Manganese [Mn] as principal constituent
2224/29155 . . . . . . Nickel [Ni] as principal constituent
2224/29157 . . . . . . Cobalt [Co] as principal constituent
2224/2916 . . . . . . Iron [Fe] as principal constituent
2224/29163 . . . . . . the principal constituent melting at a temperature of greater than 1550°C
2224/29164 . . . . . . Palladium [Pd] as principal constituent
Materials of the matrix with a principal constituent being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof with a principal constituent melting at a temperature of less than 400°C.

Platinum [Pt] as principal constituent

Zirconium [Zr] as principal constituent

Chromium [Cr] as principal constituent

Vanadium [V] as principal constituent

Rhodium [Rh] as principal constituent

 Ruthenium [Ru] as principal constituent

Iridium [Ir] as principal constituent

Niobium [Nb] as principal constituent

Molybdenum [Mo] as principal constituent

Tantalum [Ta] as principal constituent

Rhenium [Re] as principal constituent

Tungsten [W] as principal constituent

Titanium [Ti] as principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L. 2224/29188)

Glasses, e.g. amorphous oxides, nitrides or fluorides

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

The principal constituent being a polymer, e.g. polyester, phenolic based polymer, epoxy

with a principal constituent not provided for in groups H01L. 2224/291 - H01L. 2224/29191, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent not provided for in groups H01L. 2224/291 - H01L. 2224/29191, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent not provided for in groups H01L. 2224/291 - H01L. 2224/29191, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent not provided for in groups H01L. 2224/291 - H01L. 2224/29191, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Antimony [Sb] as principal constituent

Silver [Ag] as principal constituent

Gold [Au] as principal constituent

Magnesium [Mg] as principal constituent

Aluminium [Al] as principal constituent

Zinc [Zn] as principal constituent

Gamma [Ga] as principal constituent

Indium [In] as principal constituent

Tin [Sn] as principal constituent

Bismuth [Bi] as principal constituent

Thallium [Tl] as principal constituent

Lead [Pb] as principal constituent

Tungsten [W] as principal constituent melting at a temperature of greater than 1550°C

Tantalum [Ta] as principal constituent

Molybdenum [Mo] as principal constituent

Platinum [Pt] as principal constituent

Cobalt [Co] as principal constituent

Nickel [Ni] as principal constituent

Copper [Cu] as principal constituent

Manganese [Mn] as principal constituent

Nickel [Ni] as principal constituent

Cobalt [Co] as principal constituent

Iron [Fe] as principal constituent

Platinum [Pt] as principal constituent

Zirconium [Zr] as principal constituent
Fillers

Base material

with a principal constituent of the material being a metal or a metallloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

the principal constituent melting at a temperature of less than 400°C

Gallium [Ga] as principal constituent

H01L

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/29288)

Glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc [Zn] as principal constituent

Silver [Ag] as principal constituent

Gold [Au] as principal constituent

Copper [Cu] as principal constituent

Manganese [Mn] as principal constituent

Nickel [Ni] as principal constituent

Cobalt [Co] as principal constituent

Iron [Fe] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Palladium [Pd] as principal constituent

Titanium [Ti] as principal constituent

Platinum [Pt] as principal constituent

Zirconium [Zr] as principal constituent

Chromium [Cr] as principal constituent

Vanadium [V] as principal constituent

Rhodium [Rh] as principal constituent

Ruthenium [Ru] as principal constituent

Iridium [Ir] as principal constituent

Niobium [Nb] as principal constituent
Coating material with a principal constituent of the material being a metal with a principal constituent of segmented structures, foams a matrix with a filler, i.e. materials in the form of combination of two or more of the material being a gas with a principal constituent melting at a temperature of greater than or equal to 900°C and less than 1550°C.

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/29388) with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy.

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene with a principal constituent of the material being a solid not provided for in groups H01L 2224/293 - H01L 2224/29391 e.g. allotropes of carbon, fullerene, graphite, carbon nanotubes, diamond with a principal constituent of the material being a liquid not provided for in groups H01L 2224/293 - H01L 2224/29391

Glasses, e.g. amorphous oxides, nitriles or fluorides with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy.

- Molybdenum [Mo] as principal constituent
- Tantalum [Ta] as principal constituent
- Rhenium [Re] as principal constituent
- Tungsten [W] as principal constituent
- with a principal constituent of the material being a non metallic, non metalloid inorganic material
- Tellurium [Te] and polonium
- Arsenic [As], antimony [Sb], silicon [Si], germanium [Ge]
- Tin [Sn] as principal constituent
- Indium [In] as principal constituent
- Gallium [Ga] as principal constituent
- Molybdenum [Mo] as principal constituent
- Bismuth [Bi] as principal constituent
- Thallium [Tl] as principal constituent
- Lead [Pb] as principal constituent
- the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
- Zinc [Zn] as principal constituent
- Antimony [Sb] as principal constituent
- Magnesium [Mg] as principal constituent
- Aluminium [Al] as principal constituent
- the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
- Silver [Ag] as principal constituent
- Gold [Au] as principal constituent
- Copper [Cu] as principal constituent
- Manganese [Mn] as principal constituent
- Nickel [Ni] as principal constituent
- Cobalt [Co] as principal constituent
- Iron [Fe] as principal constituent
- Palladium [Pd] as principal constituent
- Titanium [Ti] as principal constituent
- Platinum [Pt] as principal constituent
- Zirconium [Zr] as principal constituent
- Chromium [Cr] as principal constituent
- Vanadium [V] as principal constituent
- Rhodium [Rh] as principal constituent
- Ruthenium [Ru] as principal constituent
- Iridium [Ir] as principal constituent
- Niobium [Nb] as principal constituent
- Molybdenum [Mo] as principal constituent
- Tantalum [Ta] as principal constituent
- tellurium [Te] and polonium
- antimony [Sb], arsenic [As], antimony [Sb], tellurium [Te] and polonium
## H01L

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2224/29483</td>
<td>Rhenium [Re] as principal constituent</td>
</tr>
<tr>
<td>2224/29484</td>
<td>Tungsten [W] as principal constituent</td>
</tr>
<tr>
<td>2224/29486</td>
<td>with a principal constituent of the material being a non metallic, non metalloid inorganic material</td>
</tr>
<tr>
<td>2224/29487</td>
<td>Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/29488)</td>
</tr>
<tr>
<td>2224/29488</td>
<td>Glasses, e.g. amorphous oxides, nitrides or fluorides</td>
</tr>
<tr>
<td>2224/2949</td>
<td>with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy</td>
</tr>
<tr>
<td>2224/29491</td>
<td>The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene</td>
</tr>
<tr>
<td>2224/29493</td>
<td>with a principal constituent of the material being a solid not provided for in groups H01L 2224/294 - H01L 2224/29491, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond</td>
</tr>
<tr>
<td>2224/29494</td>
<td>with a principal constituent of the material being a liquid not provided for in groups H01L 2224/294 - H01L 2224/29491</td>
</tr>
<tr>
<td>2224/29495</td>
<td>with a principal constituent of the material being a gas not provided for in groups H01L 2224/294 - H01L 2224/29491</td>
</tr>
<tr>
<td>2224/29498</td>
<td>with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams</td>
</tr>
<tr>
<td>2224/29499</td>
<td>Shape or distribution of the fillers</td>
</tr>
<tr>
<td>2224/2954</td>
<td>Coating</td>
</tr>
<tr>
<td>2224/29541</td>
<td>Structure</td>
</tr>
<tr>
<td>2224/2955</td>
<td>Shape</td>
</tr>
<tr>
<td>2224/29551</td>
<td>being non uniform</td>
</tr>
<tr>
<td>2224/29552</td>
<td>comprising protrusions or indentations</td>
</tr>
<tr>
<td>2224/29553</td>
<td>at the bonding interface of the layer connector, i.e. on the surface of the layer connector</td>
</tr>
<tr>
<td>2224/2956</td>
<td>Disposition</td>
</tr>
<tr>
<td>2224/29561</td>
<td>On the entire surface of the core, i.e. integral coating</td>
</tr>
<tr>
<td>2224/29562</td>
<td>On the entire exposed surface of the core</td>
</tr>
<tr>
<td>2224/29563</td>
<td>Only on parts of the surface of the core, i.e. partial coating</td>
</tr>
<tr>
<td>2224/29564</td>
<td>Only on the bonding interface of the layer connector</td>
</tr>
<tr>
<td>2224/29565</td>
<td>Only outside the bonding interface of the layer connector</td>
</tr>
<tr>
<td>2224/29566</td>
<td>Both on and outside the bonding interface of the layer connector</td>
</tr>
<tr>
<td>2224/2957</td>
<td>Single coating layer</td>
</tr>
<tr>
<td>2224/29575</td>
<td>Plural coating layers</td>
</tr>
<tr>
<td>2224/29576</td>
<td>being mutually engaged together, e.g. through inserts</td>
</tr>
<tr>
<td>2224/29578</td>
<td>being disposed next to each other, e.g. side-to-side arrangements</td>
</tr>
<tr>
<td>2224/2958</td>
<td>being stacked</td>
</tr>
<tr>
<td>2224/29582</td>
<td>Two-layer coating</td>
</tr>
<tr>
<td>2224/29583</td>
<td>Three-layer coating</td>
</tr>
<tr>
<td>2224/29584</td>
<td>Four-layer coating</td>
</tr>
<tr>
<td>2224/29599</td>
<td>Material</td>
</tr>
<tr>
<td>2224/296</td>
<td>with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof</td>
</tr>
<tr>
<td>2224/29601</td>
<td>the principal constituent melting at a temperature of less than 400°C</td>
</tr>
<tr>
<td>2224/29605</td>
<td>Gallium [Ga] as principal constituent</td>
</tr>
<tr>
<td>2224/29609</td>
<td>Indium [In] as principal constituent</td>
</tr>
<tr>
<td>2224/29611</td>
<td>Tin [Sn] as principal constituent</td>
</tr>
<tr>
<td>2224/29613</td>
<td>Bismuth [Bi] as principal constituent</td>
</tr>
<tr>
<td>2224/29614</td>
<td>Thallium [TI] as principal constituent</td>
</tr>
<tr>
<td>2224/29616</td>
<td>Lead [Pb] as principal constituent</td>
</tr>
<tr>
<td>2224/29617</td>
<td>the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C</td>
</tr>
<tr>
<td>2224/29618</td>
<td>Zinc [Zn] as principal constituent</td>
</tr>
<tr>
<td>2224/2962</td>
<td>Antimony [Sb] as principal constituent</td>
</tr>
<tr>
<td>2224/29623</td>
<td>Magnesium [Mg] as principal constituent</td>
</tr>
<tr>
<td>2224/29624</td>
<td>Aluminium [Al] as principal constituent</td>
</tr>
<tr>
<td>2224/29638</td>
<td>the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C</td>
</tr>
<tr>
<td>2224/29639</td>
<td>Silver [Ag] as principal constituent</td>
</tr>
<tr>
<td>2224/29644</td>
<td>Gold [Au] as principal constituent</td>
</tr>
<tr>
<td>2224/29647</td>
<td>Copper [Cu] as principal constituent</td>
</tr>
<tr>
<td>2224/29649</td>
<td>Manganese [Mn] as principal constituent</td>
</tr>
<tr>
<td>2224/29655</td>
<td>Nickel [Ni] as principal constituent</td>
</tr>
<tr>
<td>2224/29657</td>
<td>Cobalt [Co] as principal constituent</td>
</tr>
<tr>
<td>2224/2966</td>
<td>Iron [Fe] as principal constituent</td>
</tr>
<tr>
<td>2224/29663</td>
<td>the principal constituent melting at a temperature of greater than 1550°C</td>
</tr>
<tr>
<td>2224/29664</td>
<td>Palladium [Pd] as principal constituent</td>
</tr>
</tbody>
</table>
2224/29666 .................. Titanium [Ti] as principal constituent
2224/29669 .................. Platinum [Pt] as principal constituent
2224/2967 .................. Zirconium [Zr] as principal constituent
2224/29671 .................. Chromium [Cr] as principal constituent
2224/29672 .................. Vanadium [V] as principal constituent
2224/29673 .................. Rhodium [Rh] as principal constituent
2224/29676 .................. Ruthenium [Ru] as principal constituent
2224/29678 .................. Iridium [Ir] as principal constituent
2224/29679 .................. Niobium [Nb] as principal constituent
2224/2968 .................. Molybdenum [Mo] as principal constituent
2224/29681 .................. Tantalum [Ta] as principal constituent
2224/29683 .................. Rhenium [Re] as principal constituent
2224/29684 .................. Tungsten [W] as principal constituent
2224/29686 .................. with a principal constituent of the material being a non metallic, non metalloid inorganic material
2224/29687 .................. Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/29688)
2224/29688 .................. Glasses, e.g. amorphous oxides, nitrides or fluorides
2224/2969 .................. with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy
2224/29691 .................. The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene
2224/29693 .................. with a principal constituent of the material being a solid not provided for in groups H01L 2224/296 - H01L 2224/29691, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
2224/29694 .................. with a principal constituent of the material being a liquid not provided for in groups H01L 2224/296 - H01L 2224/29691
2224/29695 .................. with a principal constituent of the material being a gas not provided for in groups H01L 2224/296 - H01L 2224/29691
2224/29698 .................. with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams
2224/29699 .................. Material of the matrix
2224/297 .................. with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof
2224/29701 .................. the principal constituent melting at a temperature of less than 1550°C
2224/29705 .................. Gallium [Ga] as principal constituent
2224/29709 .................. Indium [In] as principal constituent
2224/29711 .................. Tin [Sn] as principal constituent
2224/29713 .................. Bismuth [Bi] as principal constituent
2224/29714 .................. Thallium [Tl] as principal constituent
2224/29716 .................. Lead [Pb] as principal constituent
2224/29717 .................. the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
2224/29718 .................. Zinc [Zn] as principal constituent
2224/2972 .................. Antimony [Sb] as principal constituent
2224/29723 .................. Magnesium [Mg] as principal constituent
2224/29724 .................. Aluminium [Al] as principal constituent
2224/29738 .................. the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
2224/29739 .................. Silver [Ag] as principal constituent
2224/29744 .................. Gold [Au] as principal constituent
2224/29747 .................. Copper [Cu] as principal constituent
2224/29749 .................. Manganese [Mn] as principal constituent
2224/29755 .................. Nickel [Ni] as principal constituent
2224/29757 .................. Cobalt [Co] as principal constituent
2224/29759 .................. Iron [Fe] as principal constituent
2224/29763 .................. the principal constituent melting at a temperature of greater than 1550°C
2224/29764 .................. Palladium [Pd] as principal constituent
2224/29766 .................. Titanium [Ti] as principal constituent
2224/29769 .................. Platinum [Pt] as principal constituent
2224/2977 .................. Zirconium [Zr] as principal constituent
Base material

with a principal constituent of the material being a metal or a metastable, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

the principal constituent melting at a temperature of less than 400°C

Gallium [Ga] as principal constituent

Indium [In] as principal constituent

Tin [Sn] as principal constituent

Bismuth [Bi] as principal constituent

Thallium [Tl] as principal constituent

Lead [Pb] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc [Zn] as principal constituent

Antimony [Sb] as principal constituent

Magnesium [Mg] as principal constituent

Aluminium [Al] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Silver [Ag] as principal constituent

Gold [Au] as principal constituent

Copper [Cu] as principal constituent

Manganese [Mn] as principal constituent

Nickel [Ni] as principal constituent

the principal constituent melting at a temperature of greater than 1550°C

Palladium [Pd] as principal constituent

Titanium [Ti] as principal constituent

Platinum [Pt] as principal constituent

Zirconium [Zr] as principal constituent

Chromium [Cr] as principal constituent

Vanadium [V] as principal constituent

Rhodium [Rh] as principal constituent

Ruthenium [Ru] as principal constituent

Iridium [Ir] as principal constituent

Niobium [Nb] as principal constituent

Molybdenum [Mo] as principal constituent

Tantalum [Ta] as principal constituent

Rhenium [Re] as principal constituent

Tungsten [W] as principal constituent

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2224/297 - H01L 2224/29791, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/297 - H01L 2224/29791

with a principal constituent of the material being a gas not provided for in groups H01L 2224/297 - H01L 2224/29791

Fillers

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/29788)

Glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being with a principal constituent of the material being a non metallic, non metalloid inorganic material

of greater than or equal to 950°C and less than 1550°C

Less than 400°C

Greater than 1550°C

Greater than or equal to 400°C and less than 950°C

Greater than or equal to 1550°C
Coating material

[Ti], and alloys thereof

tellurium [Te] and polonium

arsenic [As], antimony [Sb],
silicon [Si], germanium [Ge],
or a metalloid, e.g. boron [B],
of the material being a metal

with a principal constituent

segmented structures, foams

being a hybrid material, e.g.

materials in the form of

combination of two or more

of the material being a gas

not provided for in groups

Ceramics, e.g. crystalline

carbides, nitrides or

oxides (glass ceramics

H01L 2224/2988)

Glasses, e.g. amorphous

oxides, nitrides or fluorides

with a principal constituent of

the material being a polymer,

e.g. polyester, phenolic based

polymer, epoxy

The principal constituent

being an elastomer, e.g.
silicones, isoprene, neoprene

with a principal constituent of

the material being a solid

not provided for in groups

H01L 2224/298 - H01L 2224/29891

e.g. allotropes of carbon,

fullerenes, graphite, carbon-
nanotubes, diamond

with a principal constituent

of the material being a liquid

not provided for in groups

H01L 2224/298 - H01L 2224/29891

with a principal constituent of

the material being a gas

not provided for in groups

H01L 2224/298 - H01L 2224/29891

with a principal constituent of

the material being a metal

or a metalloid, e.g. boron [B],
silicon [Si], germanium [Ge],
arsenic [As], antimony [Sb],
tellurium [Te] and polonium

[Po], and alloys thereof

the principal constituent

melting at a temperature of

less than 400°C

Gallium [Ga] as principal

constituent

Indium [In] as principal

constituent

Tin [Sn] as principal

constituent

Bismuth [Bi] as principal

constituent

Thallium [Tl] as principal

constituent

Lead [Pb] as principal

constituent

the principal constituent

melting at a temperature of

greater than or equal to

400°C and less than 950°C

Zinc [Zn] as principal

constituent

Antimony [Sb] as principal

constituent

Magnesium [Mg] as principal

constituent

Aluminium [Al] as principal

constituent

the principal constituent

melting at a temperature of

greater than or equal to

950°C and less than 1550°C

Silver [Ag] as principal

constituent

Gold [Au] as principal

constituent

Copper [Cu] as principal

constituent

Manganese [Mn] as principal

constituent

Nickel [Ni] as principal

constituent

Cobalt [Co] as principal

constituent

Iron [Fe] as principal

constituent

the principal constituent

melting at a temperature of

greater than 1550°C

Palladium [Pd] as principal

constituent

Titanium [Ti] as principal

constituent

Platinum [Pt] as principal

constituent

Zirconium [Zr] as principal

constituent

Chromium [Cr] as principal

constituent

Vanadium [V] as principal

constituent

Rhodium [Rh] as principal

constituent

Ruthenium [Ru] as principal

constituent

Iridium [Ir] as principal

constituent

Niobium [Nb] as principal

constituent

Molybdenum [Mo] as principal

constituent

Tantalum [Ta] as principal

constituent
<table>
<thead>
<tr>
<th>CPC Numbers</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2224/29983</td>
<td>Rhenium [Re] as principal constituent</td>
</tr>
<tr>
<td>2224/29984</td>
<td>Tungsten [W] as principal constituent</td>
</tr>
<tr>
<td>2224/29986</td>
<td>with a principal constituent of the material being a non metallic, non metallloid inorganic material</td>
</tr>
<tr>
<td>2224/29987</td>
<td>Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/2998)</td>
</tr>
<tr>
<td>2224/29988</td>
<td>Glasses, e.g. amorphous oxides, nitrides or fluorides</td>
</tr>
<tr>
<td>2224/2999</td>
<td>with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy</td>
</tr>
<tr>
<td>2224/29991</td>
<td>The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene</td>
</tr>
<tr>
<td>2224/29993</td>
<td>with a principal constituent of the material being a solid not provided for in groups H01L 2224/299 - H01L 2224/29991, e.g. allotropes of carbon, fullerenes, graphite, carbon-nanotubes, diamond</td>
</tr>
<tr>
<td>2224/29994</td>
<td>with a principal constituent of the material being a liquid not provided for in groups H01L 2224/299 - H01L 2224/29991</td>
</tr>
<tr>
<td>2224/29995</td>
<td>with a principal constituent of the material being a gas not provided for in groups H01L 2224/299 - H01L 2224/29991</td>
</tr>
<tr>
<td>2224/29998</td>
<td>with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams</td>
</tr>
<tr>
<td>2224/29999</td>
<td>Shape or distribution of the fillers</td>
</tr>
<tr>
<td>2224/30</td>
<td>of a plurality of layer connectors</td>
</tr>
<tr>
<td>2224/3001</td>
<td>Structure</td>
</tr>
<tr>
<td>2224/3003</td>
<td>Layer connectors having different sizes, e.g. different heights or widths</td>
</tr>
<tr>
<td>2224/3005</td>
<td>Shape</td>
</tr>
<tr>
<td>2224/30051</td>
<td>Layer connectors having different shapes</td>
</tr>
<tr>
<td>2224/301</td>
<td>Disposition</td>
</tr>
<tr>
<td>2224/3011</td>
<td>relative to the bonding areas, e.g. bond pads, of the semiconductor or solid-state body</td>
</tr>
<tr>
<td>2224/30111</td>
<td>the layer connectors being bonded to at least one common bonding area</td>
</tr>
<tr>
<td>2224/3012</td>
<td>Layout</td>
</tr>
<tr>
<td>2224/3013</td>
<td>Square or rectangular array</td>
</tr>
<tr>
<td>2224/30131</td>
<td>being uniform, i.e. having a uniform pitch across the array</td>
</tr>
<tr>
<td>2224/30132</td>
<td>being non uniform, i.e. having a non uniform pitch across the array</td>
</tr>
<tr>
<td>2224/30133</td>
<td>with a staggered arrangement, e.g. depopulated array</td>
</tr>
<tr>
<td>2224/3014</td>
<td>covering only portions of the surface to be connected</td>
</tr>
<tr>
<td>2224/30141</td>
<td>Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements</td>
</tr>
<tr>
<td>2224/30142</td>
<td>Covering only the central area of the surface to be connected, i.e. central arrangements</td>
</tr>
<tr>
<td>2224/30143</td>
<td>Circular array, i.e. array with radial symmetry</td>
</tr>
<tr>
<td>2224/30144</td>
<td>being uniform, i.e. having a uniform pitch across the array</td>
</tr>
<tr>
<td>2224/30145</td>
<td>being non uniform, i.e. having a non uniform pitch across the array</td>
</tr>
<tr>
<td>2224/30146</td>
<td>covering only portions of the surface to be connected</td>
</tr>
<tr>
<td>2224/30147</td>
<td>Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements</td>
</tr>
<tr>
<td>2224/30148</td>
<td>Covering only the central area of the surface to be connected, i.e. central arrangements</td>
</tr>
<tr>
<td>2224/30149</td>
<td>Mirror array, i.e. array having only a reflection symmetry, i.e. bilateral symmetry</td>
</tr>
<tr>
<td>2224/3015</td>
<td>being uniform, i.e. having a uniform pitch across the array</td>
</tr>
<tr>
<td>2224/30151</td>
<td>being non uniform, i.e. having a non uniform pitch across the array</td>
</tr>
<tr>
<td>2224/30152</td>
<td>with a staggered arrangement, e.g. depopulated array</td>
</tr>
<tr>
<td>2224/30153</td>
<td>covering only portions of the surface to be connected</td>
</tr>
<tr>
<td>2224/30154</td>
<td>Covering only the peripheral area of the surface to be connected, i.e. peripheral arrangements</td>
</tr>
<tr>
<td>2224/30155</td>
<td>Covering only the central area of the surface to be connected, i.e. central arrangements</td>
</tr>
<tr>
<td>2224/30156</td>
<td>Random layout, i.e. layout with no symmetry</td>
</tr>
<tr>
<td>2224/3016</td>
<td>with a staggered arrangement</td>
</tr>
<tr>
<td>2224/30164</td>
<td>covering only portions of the surface to be connected</td>
</tr>
<tr>
<td>2224/30165</td>
<td>Covering only the central area of the surface to be connected, i.e. central arrangements</td>
</tr>
<tr>
<td>2224/30166</td>
<td>Covering only the central area of the surface to be connected, i.e. central arrangements</td>
</tr>
<tr>
<td>2224/3017</td>
<td>Combinations of arrays with different layouts</td>
</tr>
<tr>
<td>2224/30175</td>
<td>Corner adaptations, i.e. disposition of the layer connectors at the corners of the semiconductor or solid-state body</td>
</tr>
<tr>
<td>2224/3018</td>
<td>being disposed on at least two different sides of the body, e.g. dual array</td>
</tr>
<tr>
<td>2224/3019</td>
<td>On opposite sides of the body</td>
</tr>
<tr>
<td>2224/302</td>
<td>On contiguous sides of the body</td>
</tr>
<tr>
<td>2224/3020</td>
<td>Material</td>
</tr>
<tr>
<td>2224/303</td>
<td>Layer connectors having different materials</td>
</tr>
<tr>
<td>2224/3051</td>
<td>Function</td>
</tr>
</tbody>
</table>

CPC - 2019.08

103
Layer connectors having different functions

Including layer connectors providing primarily mechanical bonding

Including layer connectors providing primarily thermal dissipation

Structure, shape, material or disposition of the layer connectors after the connecting process

of an individual layer connector

Structure relative to the bonding area, e.g. bond pad

the layer connector being larger than the bonding area, e.g. bond pad

the layer connector being smaller than the bonding area, e.g. bond pad

Shape

in top view

being non uniform along the layer connector

being rectangular or square

being circular or elliptic

comprising protrusions or indentations

in side view

being non uniform along the layer connector

comprising protrusions or indentations

of bonding interfaces, e.g. interlocking features

Disposition relative to the bonding area, e.g. bond pad

the layer connector connecting bonding areas being not aligned with respect to each other

the layer connector connecting one bonding area to at least two respective bonding areas

the layer connector being disposed in a recess of the surface

the layer connector being at least partially embedded in the surface

the whole layer connector protruding from the surface

the layer connector connecting within a semiconductor or solid-state body, i.e. connecting two bonding areas on the same semiconductor or solid-state body

the layer connector connecting between different semiconductor or solid-state bodies, i.e. chip-to-chip

the bodies being arranged next to each other, e.g. on a common substrate

the bodies being arranged on opposite sides of a substrate, e.g. mirror arrangements

the bodies being stacked

the layer connector connecting to a via connection in the semiconductor or solid-state body

the layer connector connecting to a bonding area disposed in a recess of the surface

the layer connector connecting to a bonding area protruding from the surface

the layer connector connecting between a semiconductor or solid-state body and an item not being a semiconductor or solid-state body, e.g. chip-to-substrate, chip-to-passive

the body and the item being arranged next to each other, e.g. on a common substrate

the item being non-metallic, e.g. being an insulating substrate with or without metallisation

the layer connector connecting to a bond pad of the item

the layer connector connecting to a pin of the item

the layer connector connecting to a potential ring of the item

the layer connector connecting to a via metallisation of the item

the layer connector connecting to a bonding area disposed in a recess of the surface of the item

the layer connector connecting to a bonding area protruding from the surface of the item

the layer connector connecting to a potential ring of the item

the layer connector connecting to a bonding area disposed in a recess of the surface of the item

the layer connector connecting to a bonding area protruding from the surface of the item

the item being a discrete passive component

the layer connector connecting to a bonding area disposed in a recess of the surface of the item

the layer connector connecting to a bonding area protruding from the surface of the item

the body and the item being stacked

the item being non-metallic, e.g. insulating substrate with or without metallisation

the layer connector connecting to a bond pad of the item

the layer connector connecting to a pin of the item

the layer connector connecting to a potential ring of the item

the layer connector connecting to a via metallisation of the item

the layer connector connecting to a bonding area disposed in a recess of the surface of the item
of a plurality of layer connectors
prior to the connecting process

Layout (layout of layer connectors
pads relative to the bonding areas, e.g. bond
shapes

Layer connectors having different
e.g. different heights or widths

Layer connectors having different sizes,
including layer connectors providing
primarily thermal dissipation

Layer connectors being disposed on at least two different
sides of the body, e.g. dual array

Corner adaptations, i.e. disposition of
the layer connectors at the corners of
the semiconductor or solid-state body

being disposed on at least two different
sides of the body, e.g. dual array

On opposite sides of the body

On contiguous sides of the body

Layer connectors having different
materials

Layer connectors having different
functions

including layer connectors providing
primarily mechanical support

including layer connectors providing
primarily thermal dissipation

Strap connectors, e.g. copper straps for grounding
power devices; Manufacturing methods related
ereto

Covering only the central area of
the surface to be connected, i.e.
central arrangements

Random layout, i.e. layout with no
symmetry

with a staggered arrangement
covering only portions of the
surface to be connected

Covering only the peripheral area
of the surface to be connected, i.e.
peripheral arrangements

Covering only the central area of
the surface to be connected, i.e.
peripheral arrangements

Covering only the peripheral area
of the surface to be connected, i.e.
peripheral arrangements

Covering only the central area of
the surface to be connected, i.e.
peripheral arrangements

Corner adaptations, i.e. disposition of
the layer connectors at the corners of
the semiconductor or solid-state body

being disposed on at least two different
sides of the body, e.g. dual array

On opposite sides of the body

On contiguous sides of the body

Layer connectors having different
materials

Layer connectors having different
functions

including layer connectors providing
primarily mechanical support

including layer connectors providing
primarily thermal dissipation

Strap connectors, e.g. copper straps for grounding
power devices; Manufacturing methods related
thereto

Manufacturing methods
2224/35001 . . . . Involving a temporary auxiliary member not forming part of the manufacturing apparatus, e.g. removable or sacrificial coating, film or substrate
2224/351 . . . . Pre-treatment of the preform connector
2224/3512 . . . . Applying permanent coating, e.g. in-situ coating
2224/35125 . . . . Plating, e.g. electroplating, electroless plating
2224/352 . . . . Mechanical processes
2224/3521 . . . . Pulling
2224/355 . . . . Modification of a pre-existing material
2224/3551 . . . . Sintering
2224/3552 . . . . Anodisation
2224/357 . . . . Involving monitoring, e.g. feedback loop
2224/358 . . . . Post-treatment of the connector
2224/3581 . . . . Cleaning, e.g. oxide removal step, desmearing
2224/3582 . . . . Applying permanent coating, e.g. in-situ coating
2224/35821 . . . . Spray coating
2224/35822 . . . . Dip coating
2224/35823 . . . . Immersion coating, e.g. solder bath
2224/35824 . . . . Chemical solution deposition [CSD], i.e. using a liquid precursor
2224/35825 . . . . Plating, e.g. electroplating, electroless plating
2224/35826 . . . . Physical vapour deposition [PVD], e.g. evaporation, sputtering
2224/35827 . . . . Chemical vapour deposition [CVD], e.g. laser CVD
2224/3583 . . . . Reworking
2224/35831 . . . . with a chemical process, e.g. with etching of the connector
2224/35847 . . . . with a mechanical process, e.g. with flattening of the connector
2224/35848 . . . . Thermal treatments, e.g. annealing, controlled cooling
2224/35985 . . . . Methods of manufacturing strap connectors involving a specific sequence of method steps
2224/35986 . . . . with repetition of the same manufacturing step
2224/36 . . . . Structure, shape, material or disposition of the strap connectors prior to the connecting process
2224/37 . . . . of an individual strap connector
2224/37001 . . . . Core members of the connector
2224/37005 . . . . Structure
2224/3701 . . . . Shape
2224/37011 . . . . comprising apertures or cavities
2224/37012 . . . . Cross-sectional shape
2224/37013 . . . . being non uniform along the connector
2224/3702 . . . . Disposition
2224/37025 . . . . Plural core members
2224/37026 . . . . being mutually engaged together, e.g. through inserts
2224/37028 . . . . Side-to-side arrangements
2224/3703 . . . . Stacked arrangements
2224/37032 . . . . Two-layer arrangements
2224/37033 . . . . Three-layer arrangements
2224/37034 . . . . Four-layer arrangements
2224/37099 . . . . Material

2224/371 . . . . with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof
2224/37101 . . . . the principal constituent melting at a temperature of less than 400°C
2224/37105 . . . . Gallium [Ga] as principal constituent
2224/37109 . . . . Indium [In] as principal constituent
2224/37111 . . . . Tin [Sn] as principal constituent
2224/37113 . . . . Bismuth [Bi] as principal constituent
2224/37114 . . . . Thallium [Tl] as principal constituent
2224/37116 . . . . Lead [Pb] as principal constituent
2224/37117 . . . . the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
2224/37118 . . . . Zinc [Zn] as principal constituent
2224/3712 . . . . Antimony [Sb] as principal constituent
2224/37123 . . . . Magnesium [Mg] as principal constituent
2224/37124 . . . . Aluminium [Al] as principal constituent
2224/37138 . . . . the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
2224/37139 . . . . Silver [Ag] as principal constituent
2224/37144 . . . . Gold [Au] as principal constituent
2224/37147 . . . . Copper [Cu] as principal constituent
2224/37149 . . . . Manganese [Mn] as principal constituent
2224/37155 . . . . Nickel [Ni] as principal constituent
2224/37157 . . . . Cobalt [Co] as principal constituent
2224/3716 . . . . Iron [Fe] as principal constituent
2224/37163 . . . . the principal constituent melting at a temperature of greater than 1550°C
2224/37164 . . . . Palladium [Pd] as principal constituent
2224/37166 . . . . Titanium [Ti] as principal constituent
2224/37169 . . . . Platinum [Pt] as principal constituent
2224/3717 . . . . Zirconium [Zr] as principal constituent
2224/37171 . . . . Chromium [Cr] as principal constituent
2224/37172 . . . . Vanadium [V] as principal constituent
2224/37173 . . . . Rhodium [Rh] as principal constituent
2224/37176 . . . . Ruthenium [Ru] as principal constituent
foams, material, e.g. segmented structures, matrix with a filler, i.e. being a hybrid or more materials in the form of a material being a combination of two with a principal constituent of the material being a gas not provided for in groups H01L 2224/371.

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/37188).

Glasses, e.g. amorphous oxides, nitrides or fluorides with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy.

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene.

with a principal constituent of the material being a solid not provided for in groups H01L 2224/3711 - H01L 2224/37191, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond.

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/3711 - H01L 2224/37191.

with a principal constituent of the material being a gas not provided for in groups H01L 2224/3711 - H01L 2224/37191.

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Material of the matrix.

with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof.

the principal constituent melting at a temperature of less than 400°C.

Gallium [Ga] as principal constituent.

Indium [In] as principal constituent.

Tin [Sn] as principal constituent.
Fillers

- Base material
- with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof
- the principal constituent melting at a temperature of less than 400°C
- Gallium [Ga] as principal constituent
- Indium [In] as principal constituent
- Tin [Sn] as principal constituent
- Bismuth [Bi] as principal constituent
- Thallium [Tl] as principal constituent
- Lead [Pb] as principal constituent
- the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
- Zinc [Zn] as principal constituent
- Antimony [Sb] as principal constituent
- Magnesium [Mg] as principal constituent
- Aluminium [Al] as principal constituent
- the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
- Silver [Ag] as principal constituent
- Gold [Au] as principal constituent
- Copper [Cu] as principal constituent
- Manganese [Mn] as principal constituent
- Nickel [Ni] as principal constituent
- Cobalt [Co] as principal constituent
- Iron [Fe] as principal constituent
- the principal constituent melting at a temperature of greater than 1550°C
- Palladium [Pd] as principal constituent
- Titanium [Ti] as principal constituent
- Platinum [Pt] as principal constituent
- Zirconium [Zr] as principal constituent
- Chromium [Cr] as principal constituent
- Vanadium [V] as principal constituent
- Rhodium [Rh] as principal constituent
- Ruthenium [Ru] as principal constituent
- Iridium [Ir] as principal constituent
- Niobium [Nb] as principal constituent
- Molybdenum [Mo] as principal constituent
- Tantalum [Ta] as principal constituent
- Rhenium [Re] as principal constituent
- Tungsten [W] as principal constituent
- with a principal constituent of the material being a non metallic, non metalloid inorganic material
- Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics
- H01L 2224/37288)
- with a principal constituent of the material being a non metallic, non metalloid inorganic material
- Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics
- H01L 2224/37288)
Coating material

[Po], and alloys thereof
tellurium [Te] and polonium
arsenic [As], antimony [Sb],
silicon [Si], germanium [Ge],
or a metalloid, e.g. boron [B],
of the material being a metal
with a principal constituent
segmented structures, foams
being a hybrid material, e.g.
materials in the form of
combination of two or more
of the material being a solid
not provided for in groups
H01L 2224/373 - H01L 2224/37391
e.g. allotropes of carbon,
fullerene, graphite, carbon-
nanotubes, diamond

The principal constituent
being an elastomer, e.g.
silicones, isoprene, neoprene
with a principal constituent
of the material being a solid
not provided for in groups
H01L 2224/373 - H01L 2224/37391
of the material being a liquid
not provided for in groups
H01L 2224/373 - H01L 2224/37391
of the material being a gas
not provided for in groups
H01L 2224/373 - H01L 2224/37391
with a principal constituent
of the material being a metal
or a metalloid, e.g. boron [B],
silicon [Si], germanium [Ge],
arsenic [As], antimony [Sb],
tellurium [Te] and polonium
[Po], and alloys thereof
with a principal constituent
of the material being a metal
or a metalloid, e.g. boron [B],
silicon [Si], germanium [Ge],
arsenic [As], antimony [Sb],
tellurium [Te] and polonium
[Po], and alloys thereof
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
of the material being a non
metallic, non metalloid
inorganic material
Ceramics, e.g. crystalline
carbides, nitrides or
oxides (glass ceramics
H01L 2224/37488)
Glasses, e.g. amorphous
oxides, nitrides or fluorides

Glasses, e.g. amorphous
oxides, nitrides or fluorides
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
e.g. polyester, phenolic based
polymer, epoxy
with a principal constituent
of the material being a polymer,
with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy.

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene.

with a principal constituent of the material being a solid not provided for in groups H01L 2224/374 - H01L 2224/37491, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond.

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/374 - H01L 2224/37491

with a principal constituent of the material being a gas not provided for in groups H01L 2224/374 - H01L 2224/37491

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

Shape or distribution of the fillers

Coating

Structure

Disposition, e.g. coating on a part of the core

Single coating layer

Plural coating layers

Two-layer stack coating

Three-layer stack coating

Four-layer stack coating

being mutually engaged together, e.g. through inserts

being disposed next to each other, e.g. side-to-side arrangements

Material

with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc [Zn] as principal constituent

Antimony [Sb] as principal constituent

Magnesium [Mg] as principal constituent

Aluminium [Al] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Silver [Ag] as principal constituent

Gold [Au] as principal constituent

Copper [Cu] as principal constituent

Manganese [Mn] as principal constituent

Nickel [Ni] as principal constituent

Cobalt [Co] as principal constituent

Iron [Fe] as principal constituent

the principal constituent melting at a temperature of greater than 1550°C

Palladium [Pd] as principal constituent

Titanium [Ti] as principal constituent

Platinum [Pt] as principal constituent

Zirconium [Zr] as principal constituent

Chromium [Cr] as principal constituent

Vanadium [V] as principal constituent

Rhodium [Rh] as principal constituent

Ruthenium [Ru] as principal constituent

Iridium [Ir] as principal constituent

Niobium [Nb] as principal constituent

Molybdenum [Mo] as principal constituent

Tantalum [Ta] as principal constituent

Rhenium [Re] as principal constituent

Tungsten [W] as principal constituent

with a principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrates or oxides (glass ceramics H01L 2224/37688)
Glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2224/3769 - H01L 2224/37691, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/3769 - H01L 2224/37691

with a principal constituent of the material being a gas not provided for in groups H01L 2224/376 - H01L 2224/37691

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

Material of the matrix

with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

the principal constituent melting at a temperature of less than 400°C

Gallium [Ga] as principal constituent

Indium [In] as principal constituent

Tin [Sn] as principal constituent

Bismuth [Bi] as principal constituent

Thallium [Tl] as principal constituent

Lead [Pb] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc [Zn] as principal constituent

Antimony [Sb] as principal constituent

Magnesium [Mg] as principal constituent

Aluminium [Al] as principal constituent

Silver [Ag] as principal constituent

Gold [Au] as principal constituent

Copper [Cu] as principal constituent

Manganese [Mn] as principal constituent

Nickel [Ni] as principal constituent

Cobalt [Co] as principal constituent

Iron [Fe] as principal constituent

Zirconium [Zr] as principal constituent

Chromium [Cr] as principal constituent

Vanadium [V] as principal constituent

Rhodium [Rh] as principal constituent

Platinum [Pt] as principal constituent

Zirconium [Zr] as principal constituent

Iridium [Ir] as principal constituent

Niobium [Nb] as principal constituent

Molybdenum [Mo] as principal constituent

Tantalum [Ta] as principal constituent

Rhenium [Re] as principal constituent

Tungsten [W] as principal constituent

with a principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/37788)

Glasses, e.g. amorphous oxides, nitrides or fluorides with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy
The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2224/377 - H01L 2224/37791, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/377 - H01L 2224/37791

with a principal constituent of the material being a gas not provided for in groups H01L 2224/377 - H01L 2224/37791

Fillers

Base material

with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

the principal constituent melting at a temperature of less than 400°C

Gallium [Ga] as principal constituent

Indium [In] as principal constituent

Tin [Sn] as principal constituent

Bismuth [Bi] as principal constituent

Thallium [Tl] as principal constituent

Lead [Pb] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc [Zn] as principal constituent

Antimony [Sb] as principal constituent

Magnesium [Mg] as principal constituent

Aluminium [Al] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Silver [Ag] as principal constituent

Gold [Au] as principal constituent

Copper [Cu] as principal constituent

Manganese [Mn] as principal constituent

Nickel [Ni] as principal constituent

Cobalt [Co] as principal constituent

Iron [Fe] as principal constituent

the principal constituent melting at a temperature of greater than 1550°C

Palladium [Pd] as principal constituent

Titanium [Ti] as principal constituent

Platinum [Pt] as principal constituent

Zirconium [Zr] as principal constituent

Chromium [Cr] as principal constituent

Vanadium [V] as principal constituent

Rhodium [Rh] as principal constituent

Ruthenium [Ru] as principal constituent

Iridium [Ir] as principal constituent

Niobium [Nb] as principal constituent

Molybdenum [Mo] as principal constituent

Tantalum [Ta] as principal constituent

Rhenium [Re] as principal constituent

Tungsten [W] as principal constituent

with a principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/3788)

Glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2224/378 - H01L 2224/37891, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
Coating material

with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof, melting at a temperature of greater than or equal to 950°C and less than 1550°C.

Nickel [Ni] as principal constituent
Manganese [Mn] as principal constituent
Copper [Cu] as principal constituent
Gold [Au] as principal constituent
Silver [Ag] as principal constituent
Tin [Sn] as principal constituent
Indium [In] as principal constituent
Gallium [Ga] as principal constituent
Magnesium [Mg] as principal constituent
Aluminium [Al] as principal constituent
Titanium [Ti] as principal constituent
Platinum [Pt] as principal constituent
Zirconium [Zr] as principal constituent
Rhenium [Re] as principal constituent
Iridium [Ir] as principal constituent
Palladium [Pd] as principal constituent
Vanadium [V] as principal constituent
Rhodium [Rh] as principal constituent
Chromium [Cr] as principal constituent
Niobium [Nb] as principal constituent
Molybdenum [Mo] as principal constituent
Tantalum [Ta] as principal constituent
Tungsten [W] as principal constituent
Hafnium [Hf] as principal constituent
Thorium [Th] as principal constituent
Cobalt [Co] as principal constituent
Iron [Fe] as principal constituent
Rubidium [Rb] as principal constituent
With a principal constituent of the material being a solid, e.g. metallic, non metalloid inorganic material, glasses, e.g. amorphous oxides, oxides or fluorides with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene with a principal constituent of the material being a solid not provided for in groups H01L 2224/379 - H01L 2224/3791, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

With a principal constituent of the material being a liquid not provided for in groups H01L 2224/379 - H01L 2224/3791

With a principal constituent of the material being a gas not provided for in groups H01L 2224/378 - H01L 2224/37891
Structure, shape, material or disposition of the chip-to-substrate, chip-to-passive semiconductor or solid-state body, e.g. solid-state body and an item not being a connecting between a semiconductor or solid-state bodies, i.e. connecting bonding areas at different heights, e.g. horizontal bond.

The connector being orthogonal to a side surface of the semiconductor or solid-state body, e.g. parallel layout.

The connector not being orthogonal to a side surface of the semiconductor or solid-state body, e.g. fanned-out connectors, radial layout.

The strap connector extending above another semiconductor or solid-state body.

Connecting within a semiconductor or solid-state body, i.e. fly strap, bridge strap.

With an intermediate bond, e.g. continuous strap daisy chain.

Connecting between different semiconductor or solid-state bodies, i.e. chip-to-chip.

The bodies being arranged next to each other, e.g. on a common substrate.

With an intermediate bond, e.g. continuous strap daisy chain.

The bodies being arranged on opposite sides of a substrate, e.g. mirror arrangements.

The bodies being stacked.

With an intermediate bond, e.g. continuous strap daisy chain.

Connecting between a semiconductor or solid-state body and an item not being a semiconductor or solid-state body, e.g. chip-to-substrate, chip-to-passive.

The body and the item being arranged next to each other, e.g. on a common substrate.

The item being non-metallic, e.g. insulating substrate with or without metallisation.

Connecting the strap to a bond pad of the item.

The bond pad being disposed in a recess of the surface of the item.

The bond pad protruding from the surface of the item.

Connecting the strap to a pin of the item.

Connecting the strap to a potential ring of the item.

Connecting the strap to a via metallisation of the item.

The item being metallic.

Connecting the strap to a bond pad of the item.

The bond pad being disposed in a recess of the surface of the item.

The bond pad protruding from the surface of the item.

Connecting the strap to a potential ring of the item.

The item being a discrete passive component.

Connecting the strap to a bond pad of the item.

The bond pad being disposed in a recess of the surface of the item.

The bond pad protruding from the surface of the item.

Connecting the strap to a pin of the item.

Connecting the strap to a potential ring of the item.

Connecting the strap to a via metallisation of the item.

Connecting the strap to a die pad of the item.

Connecting between the body and an opposite side of the item with respect to the body.

Connecting the strap to a bond pad of the item.

The bond pad being disposed in a recess of the surface of the item.

The bond pad protruding from the surface of the item.

Connecting the strap to a potential ring of the item.

Connecting the strap to a die pad of the item.
Connecting between the body and an opposite side of the item with respect to the body

Connecting portions with multiple bonds on the same bonding area

Connected to auxiliary connecting means on the bonding areas

Being a pre-ball (i.e. a ball formed by capillary bonding)

On the semiconductor or solid-state body

Outside the semiconductor or solid-state body

Being a plurality of pre-balls disposed side-to-side

On the semiconductor or solid-state body

Outside the semiconductor or solid-state body

Being an additional member attached to the bonding area through an adhesive or solder, e.g. buffer pad

Not being interposed between the connector and the bonding area

Material of the auxiliary connecting means

Material at the bonding interface

Comprising an eutectic alloy

Comprising an intermetallic compound

Morphology of the connecting portion, e.g. grain size distribution

Bonding interface between the connecting portion and the bonding area

Auxiliary members for strap connectors, e.g. flow-barriers, spacers

Being formed on the semiconductor or solid-state body to be connected

Reinforcing structures

Alignment aids

Being formed on an item to be connected not being a semiconductor or solid-state body

Reinforcing structures

Alignment aids of a plurality of strap connectors

Structure

Connectors having different sizes

Shape

Connectors having different shapes

Different loop heights

Disposition

Connecting at different heights

On the semiconductor or solid-state body being

Outside the semiconductor or solid-state body

the connectors being bonded to at least one common bonding area, e.g. daisy chain

the connectors connecting two common bonding areas

the connectors connecting a common bonding area on the semiconductor or solid-state body to different bonding areas outside the body, e.g. diverging straps

the connectors connecting different bonding areas on the semiconductor or solid-state body to a common bonding area outside the body, e.g. converging straps

Layout

Crossed straps

Fan-out arrangements

Radial fan-out arrangements

Stacked arrangements

Parallel arrangements

Strap connectors having the same loop shape and height

Combinations of different arrangements

Corner adaptations, i.e. disposition of the strap connectors at the corners of the semiconductor or solid-state body

Being disposed on at least two different sides of the body, e.g. dual array

Connecting portions

The connecting portions being stacked

On the semiconductor or solid-state body

Outside the semiconductor or solid-state body

The connecting portions being staggered

Material

Connectors having different materials

Wire connectors; Manufacturing methods related thereto

Manufacturing methods

Involving a temporary auxiliary member not forming part of the manufacturing apparatus, e.g. removable or sacrificial coating, film or substrate

Pre-treatment of the preform connector

Applying permanent coating, e.g. in-situ coating

Plating, e.g. electroplating, electroless plating

Mechanical processes

Pulling

Modification of a pre-existing material

Sintering

Anodisation

Involving monitoring, e.g. feedback loop

Post-treatment of the connector

Cleaning, e.g. oxide removal step, desmearing

Applying permanent coating, e.g. in-situ coating

Spray coating
H01L

2224/43822 . . . . . . Dip coating
2224/43823 . . . . . . Immersion coating, e.g. solder bath
2224/43824 . . . . . . Chemical solution deposition [CSD], i.e. using a liquid precursor
2224/43825 . . . . . . Plating, e.g. electroplating, electroless plating
2224/43826 . . . . . . Physical vapour deposition [PVD], e.g. evaporation, sputtering
2224/43827 . . . . . . Chemical vapour deposition [CVD], e.g. laser CVD
2224/4383 . . . . . . Reworking
2224/43831 . . . . . . with a chemical process, e.g. with etching of the connector
2224/43847 . . . . . . with a mechanical process, e.g. with flattening of the connector
2224/43848 . . . . . . Thermal treatments, e.g. annealing, controlled cooling
2224/43985 . . . . . . Methods of manufacturing wire connectors involving a specific sequence of method steps
2224/43986 . . . . . . with repetition of the same manufacturing step
2224/44 . . . . . . Structure, shape, material or disposition of the wire connectors prior to the connecting process
2224/45 . . . . . . of an individual wire connector
2224/45001 . . . . . . Core members of the connector
2224/45005 . . . . . . Structure
2224/4501 . . . . . . Shape
2224/45012 . . . . . . Cross-sectional shape
2224/45013 . . . . . . being non uniform along the connector
2224/45014 . . . . . . Ribbon connectors, e.g. rectangular cross-section
2224/45015 . . . . . . being circular
2224/45016 . . . . . . being elliptic
2224/4502 . . . . . . Disposition
2224/45025 . . . . . . Plural core members
2224/45026 . . . . . . being mutually engaged together, e.g. through inserts
2224/45028 . . . . . . Side-to-side arrangements
2224/4503 . . . . . . Stacked arrangements
2224/45032 . . . . . . Two-layer arrangements
2224/45033 . . . . . . Three-layer arrangements
2224/45034 . . . . . . Four-layer arrangements
2224/45099 . . . . . . Material
2224/451 . . . . . . with a principal constituent of the material being a metal or a metalloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof
2224/45101 . . . . . . Gallium (Ga) as principal constituent
2224/45105 . . . . . . Indium (In) as principal constituent
2224/45109 . . . . . . Tin (Sn) as principal constituent
2224/4511 . . . . . . Bismuth (Bi) as principal constituent
2224/45113 . . . . . . Thallium (Tl) as principal constituent
2224/45116 . . . . . . Lead (Pb) as principal constituent
2224/45117 . . . . . . the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
2224/45118 . . . . . . Zinc (Zn) as principal constituent
2224/4512 . . . . . . Antimony (Sb) as principal constituent
2224/45123 . . . . . . Magnesium (Mg) as principal constituent
2224/45124 . . . . . . Aluminium (Al) as principal constituent
2224/45138 . . . . . . the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
2224/45139 . . . . . . Silver (Ag) as principal constituent
2224/4514 . . . . . . Gold (Au) as principal constituent
2224/45147 . . . . . . Copper (Cu) as principal constituent
2224/45149 . . . . . . Manganese (Mn) as principal constituent
2224/45155 . . . . . . Nickel (Ni) as principal constituent
2224/45157 . . . . . . Cobalt (Co) as principal constituent
2224/4516 . . . . . . Iron (Fe) as principal constituent
2224/45163 . . . . . . the principal constituent melting at a temperature of greater than 1550°C
2224/45164 . . . . . . Palladium (Pd) as principal constituent
2224/45166 . . . . . . Titanium (Ti) as principal constituent
2224/45169 . . . . . . Platinum (Pt) as principal constituent
2224/4517 . . . . . . Zirconium (Zr) as principal constituent
2224/45171 . . . . . . Chromium (Cr) as principal constituent
2224/45172 . . . . . . Vanadium (V) as principal constituent
2224/45173 . . . . . . Rhodium (Rh) as principal constituent
2224/45176 . . . . . . Ruthenium (Ru) as principal constituent
2224/45178 . . . . . . Iridium (Ir) as principal constituent
2224/45179 . . . . . . Niobium (Nb) as principal constituent
2224/4518 . . . . . . Molybdenum (Mo) as principal constituent
2224/45181 . . . . . . Tantalum (Ta) as principal constituent
2224/45183 . . . . . . Rhenium (Re) as principal constituent
2224/45184 . . . . . . Tungsten (W) as principal constituent
2224/45186 . . . . . . with a principal constituent of the material being a non metallic, non metalloid inorganic material
2224/45187 . . . . . . Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/45188)
Glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2224/451 - H01L 2224/4519, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/451 - H01L 2224/4519

with a principal constituent of the material being a gas not provided for in groups H01L 2224/451 - H01L 2224/4519

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

Material of the matrix

with a principal constituent of the material being a metal or a metalloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof

the principal constituent melting at a temperature of less than 400°C

Gallium (Ga) as principal constituent

Indium (In) as principal constituent

Tin (Sn) as principal constituent

Bismuth (Bi) as principal constituent

Thallium (Tl) as principal constituent

Lead (Pb) as principal constituent

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc (Zn) as principal constituent

Antimony (Sb) as principal constituent

Magnesium (Mg) as principal constituent

Aluminium (Al) as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Silver (Ag) as principal constituent

Gold (Au) as principal constituent

Copper (Cu) as principal constituent

Manganese (Mn) as principal constituent

Nickel (Ni) as principal constituent

Cobalt (Co) as principal constituent

Iron (Fe) as principal constituent

the principal constituent melting at a temperature of greater than 1550°C

Palladium (Pd) as principal constituent

Titanium (Ti) as principal constituent

Platinum (Pt) as principal constituent

Zirconium (Zr) as principal constituent

Chromium (Cr) as principal constituent

Vanadium (V) as principal constituent

Rhodium (Rh) as principal constituent

Ruthenium (Ru) as principal constituent

Iridium (Ir) as principal constituent

Niobium (Nb) as principal constituent

Molybdenum (Mo) as principal constituent

Tantalum (Ta) as principal constituent

Rhenium (Re) as principal constituent

Tungsten (W) as principal constituent

with a principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/4528)

Glasses, e.g. amorphous oxides, nitrides or fluorides with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy
The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene with a principal constituent of the material being a solid not provided for in groups H01L 2224/452 - H01L 2224/45291, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond with a principal constituent of the material being a liquid not provided for in groups H01L 2224/45291, with a principal constituent of the material being a gas not provided for in groups H01L 2224/45291, Fillers with a principal constituent of the material being a metal or a metalloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof the principal constituent melting at a temperature of less than 400°C Gallium (Ga) as principal constituent Indium (In) as principal constituent Tin (Sn) as principal constituent Bismuth (Bi) as principal constituent Thallium (Tl) as principal constituent Lead (Pb) as principal constituent the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C Zinc (Zn) as principal constituent Antimony (Sb) as principal constituent Magnesium (Mg) as principal constituent Aluminium (Al) as principal constituent the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C Silver (Ag) as principal constituent Gold (Au) as principal constituent Copper (Cu) as principal constituent Manganese (Mn) as principal constituent Nickel (Ni) as principal constituent Cobalt (Co) as principal constituent Iron (Fe) as principal constituent the principal constituent melting at a temperature of greater than 1550°C Palladium (Pd) as principal constituent Titanium (Ti) as principal constituent Platinum (Pt) as principal constituent Zirconium (Zr) as principal constituent Chromium (Cr) as principal constituent Vanadium (V) as principal constituent Rhodium (Rh) as principal constituent Ruthenium (Ru) as principal constituent Iridium (Ir) as principal constituent Tungsten (W) as principal constituent Niobium (Nb) as principal constituent Molybdenum (Mo) as principal constituent Tantalum (Ta) as principal constituent Rhenium (Re) as principal constituent Platinum (Pt) as principal constituent Titanium (Ti) as principal constituent Palladium (Pd) as principal constituent Ruthenium (Ru) as principal constituent Iridium (Ir) as principal constituent Tungsten (W) as principal constituent with a principal constituent of the material being a non metallic, non metalloid inorganic material Glasses, e.g. amorphous oxides, nitrides or fluorides (glass ceramics H01L 2224/45388) with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy with a principal constituent of the material being an elastomer, e.g. silicones, isoprene, neoprene with a principal constituent of the material being a solid not provided for in groups H01L 2224/453 - H01L 2224/45301, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2224/45457</td>
<td>Cobalt (Co) as principal constituent</td>
</tr>
<tr>
<td>2224/4546</td>
<td>Iron (Fe) as principal constituent</td>
</tr>
<tr>
<td>2224/45463</td>
<td>the principal constituent melting at a temperature of greater than 1550°C</td>
</tr>
<tr>
<td>2224/45464</td>
<td>Palladium (Pd) as principal constituent</td>
</tr>
<tr>
<td>2224/45466</td>
<td>Titanium (Ti) as principal constituent</td>
</tr>
<tr>
<td>2224/45469</td>
<td>Platinum (Pt) as principal constituent</td>
</tr>
<tr>
<td>2224/4547</td>
<td>Zirconium (Zr) as principal constituent</td>
</tr>
<tr>
<td>2224/45471</td>
<td>Chromium (Cr) as principal constituent</td>
</tr>
<tr>
<td>2224/45472</td>
<td>Vanadium (V) as principal constituent</td>
</tr>
<tr>
<td>2224/45473</td>
<td>Rhodium (Rh) as principal constituent</td>
</tr>
<tr>
<td>2224/45476</td>
<td>Ruthenium (Ru) as principal constituent</td>
</tr>
<tr>
<td>2224/45478</td>
<td>Iridium (Ir) as principal constituent</td>
</tr>
<tr>
<td>2224/45479</td>
<td>Niobium (Nb) as principal constituent</td>
</tr>
<tr>
<td>2224/4548</td>
<td>Molybdenum (Mo) as principal constituent</td>
</tr>
<tr>
<td>2224/45481</td>
<td>Tantalum (Ta) as principal constituent</td>
</tr>
<tr>
<td>2224/45483</td>
<td>Rhenium (Re) as principal constituent</td>
</tr>
<tr>
<td>2224/45484</td>
<td>Tungsten (W) as principal constituent</td>
</tr>
<tr>
<td>2224/45487</td>
<td>with a principal constituent of the material being a non-metallic, non-metallloid inorganic material</td>
</tr>
<tr>
<td>2224/45488</td>
<td>Glasses, e.g. amorphous oxides, nitrides or fluorides with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy</td>
</tr>
<tr>
<td>2224/4549</td>
<td>Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/45488)</td>
</tr>
<tr>
<td>2224/45498</td>
<td>with a principal constituent of the material being a solid not provided for in groups H01L 2224/454 - H01L 2224/45491, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond</td>
</tr>
<tr>
<td>2224/45493</td>
<td>with a principal constituent of the material being a non-metallic, non-metallloid inorganic material</td>
</tr>
<tr>
<td>2224/45494</td>
<td>with a principal constituent of the material being a liquid not provided for in groups H01L 2224/454 - H01L 2224/45491</td>
</tr>
</tbody>
</table>
Coating Material

Single coating layer

Four-layer stack coating

Three-layer stack coating

Two-layer stack coating

being mutually engaged together, e.g. through inserts

being disposed next to each other, e.g. side-to-side arrangements

Material

with a principal constituent of the material being a metal or a metalloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof

the principal constituent melting at a temperature of less than 400°C

gallium (Ga) as principal constituent

indium (In) as principal constituent

tin (Sn) as principal constituent

thallium (Tl) as principal constituent

lead (Pb) as principal constituent

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

zinc (Zn) as principal constituent

antimony (Sb) as principal constituent

magnesium (Mg) as principal constituent

aluminium (Al) as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

silver (Ag) as principal constituent

gold (Au) as principal constituent

Copper (Cu) as principal constituent

manganese (Mn) as principal constituent

nickel (Ni) as principal constituent

cobalt (Co) as principal constituent

iron (Fe) as principal constituent

the principal constituent melting at a temperature of greater than or equal to 1550°C

palladium (Pd) as principal constituent

titanium (Ti) as principal constituent

platinum (Pt) as principal constituent

zirconium (Zr) as principal constituent

chromium (Cr) as principal constituent

vanadium (V) as principal constituent

rhodium (Rh) as principal constituent

ruthenium (Ru) as principal constituent

iridium (Ir) as principal constituent

niobium (Nb) as principal constituent

molybdenum (Mo) as principal constituent

tantalum (Ta) as principal constituent

rhenium (Re) as principal constituent

tungsten (W) as principal constituent

tantalum (Ta) as principal constituent

molybdenum (Mo) as principal constituent

rhenium (Re) as principal constituent

tungsten (W) as principal constituent

ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics)

glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

the principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2224/45647 - H01L 2224/45693, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
with a principal constituent of the material being a liquid not provided for in groups H01L 2224/456 - H01L 2224/45691

with a principal constituent of the material being a gas not provided for in groups H01L 2224/456 - H01L 2224/45691

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

Material of the matrix

with a principal constituent of the material being a metal or a metalloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof

the principal constituent melting at a temperature of less than 400°C

Gallium (Ga) as principal constituent

Indium (In) as principal constituent

Tin (Sn) as principal constituent

Bismuth (Bi) as principal constituent

Thallium (Tl) as principal constituent

Lead (Pb) as principal constituent

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc (Zn) as principal constituent

Antimony (Sb) as principal constituent

Magnesium (Mg) as principal constituent

Aluminium (Al) as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Silver (Ag) as principal constituent

Gold (Au) as principal constituent

Copper (Cu) as principal constituent

Manganese (Mn) as principal constituent

Nickel (Ni) as principal constituent

Cobalt (Co) as principal constituent

Iron (Fe) as principal constituent

the principal constituent melting at a temperature of greater than 1550°C

Palladium (Pd) as principal constituent

Titanium (Ti) as principal constituent

Platinum (Pt) as principal constituent

Zirconium (Zr) as principal constituent

Chromium (Cr) as principal constituent

Vanadium (V) as principal constituent

Rhodium (Rh) as principal constituent

Ruthenium (Ru) as principal constituent

Iridium (Ir) as principal constituent

Niobium (Nb) as principal constituent

Molybdenum (Mo) as principal constituent

Tantalum (Ta) as principal constituent

Rhenium (Re) as principal constituent

Tungsten (W) as principal constituent

with a principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/45788)

Glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2224/457 - H01L 2224/45791, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/457 - H01L 2224/45791

with a principal constituent of the material being a gas not provided for in groups H01L 2224/457 - H01L 2224/45791

Fillers
The principal constituent melting at a temperature of greater than 1550°C with a principal constituent of the material being a metal or a metalloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof with a principal constituent melting at a temperature of less than 400°C.

Gallium (Ga) as principal constituent.

Indium (In) as principal constituent.

Tin (Sn) as principal constituent.

Bismuth (Bi) as principal constituent.

Thallium (Tl) as principal constituent.

Lead (Pb) as principal constituent.

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C.

Zinc (Zn) as principal constituent.

Antimony (Sb) as principal constituent.

Magnesium (Mg) as principal constituent.

Aluminium (Al) as principal constituent.

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C.

Silver (Ag) as principal constituent.

Gold (Au) as principal constituent.

Copper (Cu) as principal constituent.

Manganese (Mn) as principal constituent.

Nickel (Ni) as principal constituent.

Cobalt (Co) as principal constituent.

Iron (Fe) as principal constituent.

the principal constituent melting at a temperature of greater than 1550°C.

Palladium (Pd) as principal constituent.

Titanium (Ti) as principal constituent.

Platinum (Pt) as principal constituent.

Zirconium (Zr) as principal constituent.

Chromium (Cr) as principal constituent.

Vanadium (V) as principal constituent.

Rhodium (Rh) as principal constituent.

Ruthenium (Ru) as principal constituent.

Iridium (Ir) as principal constituent.

Niobium (Nb) as principal constituent.

Molybdenum (Mo) as principal constituent.

Tantalum (Ta) as principal constituent.

Rhenium (Re) as principal constituent.

Tungsten (W) as principal constituent.

with a principal constituent of the material being a non metallic, non metalloid inorganic material.

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics [H01L 2224/4588]).

Glasses, e.g. amorphous oxides, nitrides or fluorides with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy.

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene with a principal constituent of the material being a solid not provided for in groups [H01L 2224/458 - H01L 2224/4589], e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond with a principal constituent of the material being a liquid not provided for in groups [H01L 2224/458 - H01L 2224/4589] with a principal constituent of the material being a gas not provided for in groups [H01L 2224/458 - H01L 2224/4589] with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams.

Coating material.
with a principal constituent of the material being a metal or a metalloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof

the principal constituent melting at a temperature of less than 400°C

Gallium (Ga) as principal constituent

Indium (In) as principal constituent

Tin (Sn) as principal constituent

Bismuth (Bi) as principal constituent

Thallium (Tl) as principal constituent

Lead (Pb) as principal constituent

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc (Zn) as principal constituent

Antimony (Sb) as principal constituent

Magnesium (Mg) as principal constituent

Aluminium (Al) as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Silver (Ag) as principal constituent

Gold (Au) as principal constituent

Copper (Cu) as principal constituent

Manganese (Mn) as principal constituent

Nickel (Ni) as principal constituent

Cobalt (Co) as principal constituent

Iron (Fe) as principal constituent

the principal constituent melting at a temperature of greater than 1550°C

Palladium (Pd) as principal constituent

Titanium (Ti) as principal constituent

Platinum (Pt) as principal constituent

Zirconium (Zr) as principal constituent

Chromium (Cr) as principal constituent

Vanadium (V) as principal constituent

Rhodium (Rh) as principal constituent

Ruthenium (Ru) as principal constituent

Iridium (Ir) as principal constituent

Niobium (Nb) as principal constituent

Molybdenum (Mo) as principal constituent

Tantalum (Ta) as principal constituent

Rhenium (Re) as principal constituent

Tungsten (W) as principal constituent

with a principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/45988)

Glasses, e.g. amorphous oxides, nitrides or fluorides with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene with a principal constituent of the material being a solid not provided for in groups H01L 2224/459 - H01L 2224/45991, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/459 - H01L 2224/45991

with a principal constituent of the material being a gas not provided for in groups H01L 2224/459 - H01L 2224/45991

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

Shape or distribution of the fillers

of a plurality of wire connectors

Structure, shape, material or disposition of the wire connectors after the connecting process

of an individual wire connector

Structure
2224/48011 . . . . . . . . . . . . Length
2224/4805 . . . . . . . . . . . . Shape
2224/4807 . . . . . . . . . . . . of bonding interfaces, e.g. interlocking features
2224/4809 . . . . . . . . . . . . Loop shape
2224/48091 . . . . . . . . . . . . Arched
2224/48092 . . . . . . . . . . . . Helix
2224/48095 . . . . . . . . . . . . Kinked
2224/48096 . . . . . . . . . . . . the kinked part being in proximity to the bonding area on the semiconductor or solid-state body
2224/48097 . . . . . . . . . . . . the kinked part being in proximity to the bonding area outside the semiconductor or solid-state body
2224/481 . . . . . . . . . . . . Disposition
2224/48101 . . . . . . . . . . . . Connecting bonding areas at the same height, e.g. horizontal bond
2224/48105 . . . . . . . . . . . . Connecting bonding areas at different heights
2224/48106 . . . . . . . . . . . . the connector being orthogonal to a side surface of the semiconductor or solid-state body, e.g. parallel layout
2224/48108 . . . . . . . . . . . . the connector not being orthogonal to a side surface of the semiconductor or solid-state body, e.g. fanned-out connectors, radial layout
2224/4811 . . . . . . . . . . . . Connecting to a bonding area of the semiconductor or solid-state body located at the far end of the body with respect to the bonding area outside the semiconductor or solid-state body
2224/48111 . . . . . . . . . . . . the wire connector extending above another semiconductor or solid-state body
2224/4813 . . . . . . . . . . . . Connecting within a semiconductor or solid-state body, i.e. fly wire, bridge wire
2224/48132 . . . . . . . . . . . . with an intermediate bond, e.g. continuous wire daisy chain
2224/48135 . . . . . . . . . . . . Connecting between different semiconductor or solid-state bodies, i.e. chip-to-chip
2224/48137 . . . . . . . . . . . . the bodies being arranged next to each other, e.g. on a common substrate
2224/48138 . . . . . . . . . . . . the wire connector connecting to a bonding area disposed in a recess of the surface
2224/48139 . . . . . . . . . . . . with an intermediate bond, e.g. continuous wire daisy chain
2224/4814 . . . . . . . . . . . . the wire connector connecting to a bonding area protruding from the surface
2224/48141 . . . . . . . . . . . . the bodies being arranged on opposite sides of a substrate, e.g. mirror arrangements
2224/48145 . . . . . . . . . . . . the bodies being stacked
2224/48147 . . . . . . . . . . . . with an intermediate bond, e.g. continuous wire daisy chain
2224/48148 . . . . . . . . . . . . the wire connector connecting to a bonding area disposed in a recess of the surface
2224/48149 . . . . . . . . . . . . the wire connector connecting to a bonding area protruding from the surface
2224/48151 . . . . . . . . . . . . Connecting between a semiconductor or solid-state body and an item not being a semiconductor or solid-state body, e.g. chip-to-substrate, chip-to-passive
2224/48153 . . . . . . . . . . . . the body and the item being arranged next to each other, e.g. on a common substrate
2224/48155 . . . . . . . . . . . . the item being non-metallic, e.g. insulating substrate with or without metallisation
2224/48157 . . . . . . . . . . . . connecting the wire to a bond pad of the item
2224/48158 . . . . . . . . . . . . the bond pad being disposed in a recess of the surface of the item
2224/48159 . . . . . . . . . . . . the bond pad protruding from the surface of the item
2224/4816 . . . . . . . . . . . . connecting the wire to a pin of the item
2224/48163 . . . . . . . . . . . . connecting the wire to a potential ring of the item
2224/48165 . . . . . . . . . . . . connecting the wire to a via metallisation of the item
2224/48175 . . . . . . . . . . . . the item being metallic
2224/48177 . . . . . . . . . . . . connecting the wire to a bond pad of the item
2224/48178 . . . . . . . . . . . . the bond pad being disposed in a recess of the surface of the item
2224/48179 . . . . . . . . . . . . the bond pad protruding from the surface of the item
2224/48183 . . . . . . . . . . . . connecting the wire to a potential ring of the item
2224/48195 . . . . . . . . . . . . the item being a discrete passive component
2224/48221 . . . . . . . . . . . . the body and the item being stacked
2224/48225 . . . . . . . . . . . . the item being non-metallic, e.g. insulating substrate with or without metallisation
2224/48227 . . . . . . . . . . . . connecting the wire to a bond pad of the item
2224/48228 . . . . . . . . . . . . the bond pad being disposed in a recess of the surface of the item
2224/48229 . . . . . . . . . . . . the bond pad protruding from the surface of the item
2224/4823 . . . . . . . . . . . . connecting the wire to a pin of the item
2224/48233 . . . . . . . . . . . . connecting the wire to a potential ring of the item
2224/48235 . . . . . . . . . . . . connecting the wire to a via metallisation of the item
2224/48237 . . . . . . . . . . . . connecting the wire to a die pad of the item
2224/4824 . . . . . . . . . . . . Connecting between the body and an opposite side of the item with respect to the body
2224/48245 . . . . . . . . . . . . the item being metallic
2224/48247 . . . . . . . . . . . . connecting the wire to a bond pad of the item
2224/48248 . . . . . . . . . . . . the bond pad being disposed in a recess of the surface of the item
2224/48249 . . . . . . . . . . . . the bond pad protruding from the surface of the item
H01L

2224/48253.................connecting the wire to a potential ring of the item
2224/48257.................connecting the wire to a die pad of the item
2224/4826.................Connecting between the body and an opposite side of the item with respect to the body
2224/48265.................the item being a discrete passive component
2224/484.................Connecting portions
2224/4845.................Details of ball bonds
2224/48451.................Shape
2224/48453.................of the interface with the bonding area
2224/48455.................Details of wedge bonds
2224/48456.................Shape
2224/48458.................of the interface with the bonding area
2224/4846.................with multiple bonds on the same bonding area
2224/48463.................the connecting portion on the bonding area of the semiconductor or solid-state body being a ball bond
2224/48464.................the other connecting portion not on the bonding area also being a ball bond, i.e. ball-to-ball
2224/48465.................the other connecting portion not on the bonding area being a wedge bond, i.e. ball-to-wedge, regular stitch
2224/4847.................the connecting portion on the bonding area of the semiconductor or solid-state body being a wedge bond
2224/48471.................the other connecting portion not on the bonding area being a ball bond, i.e. wedge-to-ball, reverse stitch
2224/48472.................the other connecting portion not on the bonding area also being a wedge bond, i.e. wedge-to-wedge
2224/48475.................connected to auxiliary connecting means on the bonding areas, e.g. pre-ball, wedge-on-ball, ball-on-ball
2224/48476.................between the wire connector and the bonding area
2224/48477.................being a pre-ball (i.e. a ball formed by capillary bonding)
2224/48478.................the connecting portion being a wedge bond, i.e. wedge on pre-ball
2224/48479.................on the semiconductor or solid-state body
2224/4848.................outside the semiconductor or solid-state body
2224/48481.................the connecting portion being a ball bond, i.e. ball on pre-ball
2224/48482.................on the semiconductor or solid-state body
2224/48483.................outside the semiconductor or solid-state body
2224/48484.................being a plurality of pre-balls disposed side-to-side
2224/48485.................the connecting portion being a wedge bond, i.e. wedge on pre-ball
2224/48486.................on the semiconductor or solid-state body
2224/48487.................outside the semiconductor or solid-state body
2224/48488.................the connecting portion being a ball bond, i.e. ball on pre-ball
2224/48489.................on the semiconductor or solid-state body
2224/4849.................outside the semiconductor or solid-state body
2224/48491.................being an additional member attached to the bonding area through an adhesive or solder, e.g. buffer pad
2224/48496.................not being interposed between the wire connector and the bonding area
2224/48499.................Material of the auxiliary connecting means
2224/485.................Material
2224/48505.................at the bonding interface
2224/48506.................comprising an eutectic alloy
2224/48507.................comprising an intermetallic compound
2224/4851.................Morphology of the connecting portion, e.g. grain size distribution
2224/48511.................Heat affected zone [HAZ]
2224/4852.................Bonding interface between the connecting portion and the bonding area
2224/48599.................Principal constituent of the connecting portion of the wire connector being Gold (Au)
2224/486.................with a principal constituent of the bonding area being a metal or a metalloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof
2224/48601.................the principal constituent melting at a temperature of less than 400°C
2224/48605.................Gallium (Ga) as principal constituent
2224/48609.................Indium (In) as principal constituent
2224/48611.................Tin (Sn) as principal constituent
2224/48613.................Bismuth (Bi) as principal constituent
2224/48614.................Thallium (Tl) as principal constituent
2224/48616.................Lead (Pb) as principal constituent
2224/48617.................the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950 °C
2224/48618.................Zinc (Zn) as principal constituent
2224/4862.................Antimony (Sb) as principal constituent
2224/48623.................Magnesium (Mg) as principal constituent
Aluminium (Al) as principal constituent
the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
Silver (Ag) as principal constituent
Gold (Au) as principal constituent
Copper (Cu) as principal constituent
Manganese (Mn) as principal constituent
Nickel (Ni) as principal constituent
Cobalt (Co) as principal constituent
Iron (Fe) as principal constituent
the principal constituent melting at a temperature of greater than 1550°C
Palladium (Pd) as principal constituent
Titanium (Ti) as principal constituent
Platinum (Pt) as principal constituent
Zirconium (Zr) as principal constituent
Chromium (Cr) as principal constituent
Vanadium (V) as principal constituent
Rhodium (Rh) as principal constituent
Iridium (Ir) as principal constituent
Niobium (Nb) as principal constituent
Molybdenum (Mo) as principal constituent
Tantalum (Ta) as principal constituent
Tungsten (W) as principal constituent
with a principal constituent of the bonding area being a solid not provided for in groups H01L 2224/486 - H01L 2224/4869, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
with a principal constituent of the bonding area being a liquid not provided for in groups H01L 2224/486 - H01L 2224/4869
with a principal constituent of the bonding area being a combination of two or more material regions, i.e. being a hybrid material, e.g. segmented structures, island patterns
Principal constituent of the connecting portion of the wire connector being Aluminium (Al)
with a principal constituent of the bonding area being a metal or a metalloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof
the principal constituent melting at a temperature of less than 400°C
with a principal constituent of the bonding area being a metal or a metalloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof
Gallium (Ga) as principal constituent
Indium (In) as principal constituent
Tin (Sn) as principal constituent
Bismuth (Bi) as principal constituent
Thallium (Tl) as principal constituent
Lead (Pb) as principal constituent
the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950 °C
Zinc (Zn) as principal constituent
Antimony (Sb) as principal constituent
Magnesium (Mg) as principal constituent
Aluminium (Al) as principal constituent
the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
Silver (Ag) as principal constituent
Gold (Au) as principal constituent
Copper (Cu) as principal constituent
Manganese (Mn) as principal constituent
CPC - 2019.08
H01L

- Nickel (Ni) as principal constituent of the bonding area being a combination of two or more material regions, i.e. being a hybrid material, e.g. segmented structures, island patterns

- Palladium (Pd) as principal constituent of the connecting portion of the wire connector being Copper (Cu)

- with a principal constituent of the bonding area being a metal or a metalloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof

- Principal constituent of the bonding area being a polymer, e.g. silicones, e.g. allotropes of carbon, fullerene, diamond

- Graphite, carbon-nanotubes, e.g. amorphous oxides, ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/48788)

- Rhodium (Rh) as principal constituent

- Titanium (Ti) as principal constituent

- Platinum (Pt) as principal constituent

- Zirconium (Zr) as principal constituent

- Chromium (Cr) as principal constituent

- Vanadium (V) as principal constituent

- with a principal constituent melting at a temperature of greater than 1550°C

- with a principal constituent melting at a temperature of greater than 950°C and less than 1550°C

- with a principal constituent melting at a temperature of greater than 400°C and less than 950°C

- with a principal constituent melting at a temperature of less than 400°C

- with a principal constituent of the bonding area being a non metallic, non metalloid inorganic material

- Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/48788)

- Glasses, e.g. amorphous oxides, nitrides or fluorides

- with a principal constituent of the bonding area being a polymer, e.g. polyester, phenolic based polymer, epoxy

- The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

- with a principal constituent melting at a temperature of less than 400°C

- Molybdenum (Mo) as principal constituent

- Niobium (Nb) as principal constituent

- Iridium (Ir) as principal constituent

- Rhodium (Rh) as principal constituent

- Palladium (Pd) as principal constituent

- with a principal constituent melting at a temperature of greater than 1550°C

- Tungsten (W) as principal constituent

- Tantalum (Ta) as principal constituent

- Ruthenium (Ru) as principal constituent

- Platinum (Pt) as principal constituent

- Palladium (Pd) as principal constituent

- with a principal constituent melting at a temperature of greater than 1550°C
Titanium (Ti) as principal constituent
Platinum (Pt) as principal constituent
Zirconium (Zr) as principal constituent
Chromium (Cr) as principal constituent
Vanadium (V) as principal constituent
Rhodium (Rh) as principal constituent
Iridium (Ir) as principal constituent
Niobium (Nb) as principal constituent
Molybdenum (Mo) as principal constituent
Tantalum (Ta) as principal constituent
Rhenium (Re) as principal constituent
Tungsten (W) as principal constituent
with a principal constituent of the bonding area being a non metallic, non metalloid inorganic material
Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/48887)
Glasses, e.g. amorphous oxides, nitrides or fluorides
with a principal constituent of the bonding area being a polymer, e.g. polyester, phenolic based polymer, epoxy
The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene
with a principal constituent of the bonding area being a solid not provided for in groups H01L 2224/48893 - H01L 2224/4889, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
with a principal constituent of the bonding area being a liquid not provided for in groups H01L 2224/48894 - H01L 2224/4889
with a principal constituent of the bonding area being a combination of two or more material regions, i.e. being a hybrid material, e.g. segmented structures, island patterns
Auxiliary members for wire connectors, e.g. flow-barriers, reinforcing structures, spacers, alignment aids
being formed on the semiconductor or solid-state body to be connected
Reinforcing structures
Alignment aids
being formed on an item to be connected not being a semiconductor or solid-state body
Reinforcing structures
Alignment aids
of a plurality of wire connectors
Structure
Connectors having different sizes, e.g. different diameters
Shape
Connectors having different shapes
Different loop heights
Loop shape arrangement
parallel in plane
horizontal
vertical
Disposition
Connecting at different heights
on the semiconductor or solid-state body
outside the semiconductor or solid-state body
the connectors being bonded to at least one common bonding area, e.g. daisy chain
the connectors connecting two common bonding areas, e.g. Litz or braid wires
the connectors connecting a common bonding area on the semiconductor or solid-state body to different bonding areas outside the body, e.g. diverging wires
the connectors connecting different bonding areas on the semiconductor or solid-state body to a common bonding area outside the body, e.g. converging wires
Layout
Crossed wires
Fan-out arrangements
Radial fan-out arrangements
Stacked arrangements
Parallel arrangements
Wire connectors having the same loop shape and height
Combinations of different arrangements
Corner adaptations, i.e. disposition of the wire connectors at the corners of the semiconductor or solid-state body
being disposed on at least two different sides of the body, e.g. dual array
Connecting portions
the connecting portions being stacked
Ball bonds
on the semiconductor or solid-state body
outside the semiconductor or solid-state body
Wedge bonds
Means for bonding being of different types provided, e.g. pressure contacts using springs or clips mechanical auxiliary parts connecting the device, e.g. regular and reverse stitches

Connectors having different materials regular and reverse stitches semiconductor or solid-state body, e.g. portions of different types on the semiconductor or solid-state body.

Wire connectors having connecting portions of different types on the semiconductor or solid-state body, e.g. regular and reverse stitches

Apparatus for manufacturing arrangements for connecting or disconnecting semiconductor or solid-state bodies and for methods related thereto

Apparatus for manufacturing means for bonding, e.g. connectors

Apparatus for manufacturing bump connectors

Apparatus for manufacturing layer connectors

Apparatus for manufacturing strap connectors

Apparatus for manufacturing wire connectors

Tools for reworking, e.g. for shaping

Apparatus for connecting with bump connectors or layer connectors

Means for cleaning, e.g. brushes, for hydro blasting, for ultrasonic cleaning, for dry ice blasting, using gas-flow, by etching, by applying flux or plasma

Means for controlling the bonding environment, e.g. valves, vacuum pumps

Chamber

Vacuum chamber

High pressure chamber

Means for applying permanent coating, e.g. in-situ coating

Means for direct writing

Syringe

Jetting means, e.g. ink jet

including a laser

Means for screen printing, e.g. roller, squeegee, screen stencil

Means for applying a preform, e.g. laminator

including a vacuum-bag

Means for blanket deposition

for spin coating, i.e. spin coater

for curtain coating

for immersion coating, i.e. bath

for spray coating, i.e. nozzle

Means for physical vapour deposition [PVD], e.g. evaporation, sputtering

Means for sputtering, e.g. target

Means for evaporation
Means for applying energy, e.g. heating means

- Protection means against electrical discharge
- Means for applying energy, e.g. heating means
- in the lower part of the bonding apparatus, e.g. in the apparatus chuck
- in the upper part of the bonding apparatus, e.g. in the bonding head
- adapted for localised heating
- Polychromatic heating lamp
- Laser
- in the lower part of the bonding apparatus, e.g. in the apparatus chuck
- in the upper part of the bonding apparatus, e.g. in the bonding head
- by induction heating, i.e. coils
- in the lower part of the bonding apparatus, e.g. in the apparatus chuck
- in the upper part of the bonding apparatus, e.g. in the bonding head
- Flame torch, e.g. hydrogen torch
- Discharge electrode
- Shape of the discharge electrode
- Material of the discharge electrode
- Circuity of the discharge electrode
- Oven
- Resistance welding electrodes, i.e. for ohmic heating
- in the lower part of the bonding apparatus, e.g. in the apparatus chuck
- in the upper part of the bonding apparatus, e.g. in the bonding head
- by infrared heating, e.g. infrared heating lamp
- by means of pressure
- Bonding head
- Shape
- of the pressing surface
- being curved
- comprising protrusions
- of other parts
- Material
- Removable bonding head
- Auxiliary members on the pressing surface
- Elastomer inlay
- with retaining mechanisms
- Removable auxiliary member
- Shape of the auxiliary member
- Material of the auxiliary member
- by ultrasonic vibrations
- Eccentric cams
- in the lower part of the bonding apparatus, e.g. in the apparatus chuck
- in the upper part of the bonding apparatus, e.g. in the bonding head
- Piezoelectric transducers
- in the lower part of the bonding apparatus, e.g. in the apparatus chuck
- in the upper part of the bonding apparatus, e.g. in the bonding head
- Stable and mobile yokes
- in the lower part of the bonding apparatus, e.g. in the apparatus chuck
- in the upper part of the bonding apparatus, e.g. in the bonding head
- Ultrasonic horns
- in the lower part of the bonding apparatus, e.g. in the apparatus chuck
- in the upper part of the bonding apparatus, e.g. in the bonding head
- Design, e.g. of the wave guide
- Cooling means
- in the lower part of the bonding apparatus, e.g. in the apparatus chuck
- in the upper part of the bonding apparatus, e.g. in the bonding head
- Mechanical means, e.g. for planarising, pressing, stamping
- Means for supplying the connector to be connected in the bonding apparatus
- Storing means
- Feeding means
- Holding means
- Means for transporting the components to be connected
- Belt conveyor
- Chain conveyor
- Vibrating conveyor
- Pneumatic conveyor
- in a fluid
- Means for aligning
- in the lower part of the bonding apparatus, e.g. in the apparatus chuck
- in the upper part of the bonding apparatus, e.g. in the bonding head
- Mechanical holding means
- in the lower part of the bonding apparatus, e.g. in the apparatus chuck
- Electrostatic holding means
- in the lower part of the bonding apparatus, e.g. in the apparatus chuck
- in the upper part of the bonding apparatus, e.g. in the bonding head
- Magnetic holding means
- in the lower part of the bonding apparatus, e.g. in the apparatus chuck
- Means for optical alignment, e.g. sensors
- Guiding structures
- in the lower part of the bonding apparatus, e.g. in the apparatus chuck
- in the upper part of the bonding apparatus, e.g. in the bonding head
- Means for moving parts
- Lower part of the bonding apparatus, e.g. XY table
- Rotational mechanism
Apparatus for connecting with build-up
Means for applying energy, e.g. heating means
Means for depositing in the environment, e.g. valves, vacuum pumps
Means for controlling the bonding head
Apparatus for connecting with build-up interconnects
Means for cleaning, e.g. brushes, for hydro blasting, for ultrasonic cleaning, for dry ice blasting, using gas-flow, by etching, by applying flux or plasma
Means for controlling the bonding environment, e.g. valves, vacuum pumps
Vacuum chamber
High pressure chamber
Means for depositing
Means for direct writing
Syringe
Jetting means, e.g. ink jet
including a laser
Means for screen printing, e.g. roller, squeegee, screen stencil
Means for applying a preform, e.g. laminator
including a vacuum-bag
Means for blanket deposition
for spin coating, i.e. spin coater
for curtain coating
for immersion coating, i.e. bath
for spray coating, i.e. nozzle
Means for physical vapour deposition [PVD]
Means for sputtering, e.g. target
Means for evaporation
Means for chemical vapour deposition [CVD], e.g. for laser CVD
Means for plating, e.g. for electroplating, electroless plating
Protection means against electrical discharge
Means for applying energy, e.g. heating means
Means for controlling the bonding
applying flux or plasma
Means for cleaning, e.g. brushes, for hydro
blasting, for ultrasonic cleaning, for dry
ice blasting, using gas-flow, by etching, by
applying flux or plasma
Means for forming additional members
specially adapted for batch processes
Apparatus chuck
Shape
of the mounting surface
of other portions
Material
Auxiliary members on the pressing surface
Shape of the auxiliary member
Material of the auxiliary member
Apparatus for connecting with strap connectors
Means for applying a preform, e.g. laminator
including a vacuum-bag
Means for blanket deposition
for spin coating, i.e. spin coater
for curtain coating
for immersion coating, i.e. bath
for spray coating, i.e. nozzle
Means for physical vapour deposition
[PVD], e.g. evaporation, sputtering
Means for sputtering, e.g. target
Means for evaporation
Means for chemical vapour deposition
[CVD], e.g. for laser CVD
Means for plating, e.g. for electroplating, electroless plating
Protection means against electrical discharge
Means for applying energy, e.g. heating means
in the lower part of the bonding apparatus,
e.g. in the apparatus chuck
Means for plating, e.g. for electrophotography, electrophotographic plating
Adapted for localised heating
in the upper part of the bonding apparatus, e.g. in the apparatus chuck
in the lower part of the bonding apparatus, e.g. in the apparatus chuck
Means for electrical disconnection
Means for electrically disconnection
Means for expelling the components to be
interconnected
Means for expelling the components to be
interconnected
Means for forming additional members
Auxiliary members on the pressing surface
Means for applying a preform, e.g. laminator
including a vacuum-bag
Means for blanket deposition
for spin coating, i.e. spin coater
for curtain coating
for immersion coating, i.e. bath
for spray coating, i.e. nozzle
Means for physical vapour deposition
[PVD], e.g. evaporation, sputtering
Means for sputtering, e.g. target
Means for evaporation
Means for chemical vapour deposition
[CVD], e.g. for laser CVD
Means for plating, e.g. for electroplating, electroless plating
Protection means against electrical discharge
Means for applying energy, e.g. heating means
in the lower part of the bonding apparatus,
e.g. in the apparatus chuck
Means for plating, e.g. for electrophotography, electrophotographic plating
Adapted for localised heating
in the lower part of the bonding apparatus, e.g. in the apparatus chuck
in the upper part of the bonding apparatus, e.g. in the wedge
2224/77264 . . . by induction heating, i.e. coils
2224/77265 . . . in the lower part of the bonding apparatus, e.g. in the apparatus chuck
2224/77266 . . . in the upper part of the bonding apparatus, e.g. in the wedge
2224/77267 . . . Flame torch, e.g. hydrogen torch
2224/77268 . . . Discharge electrode
2224/77269 . . . Shape of the discharge electrode
2224/7727 . . . Material of the discharge electrode
2224/77271 . . . Circuity of the discharge electrode
2224/77272 . . . Oven
2224/7728 . . . Resistance welding electrodes, i.e. for ohmic heating
2224/77281 . . . in the lower part of the bonding apparatus, e.g. in the apparatus chuck
2224/77282 . . . in the upper part of the bonding apparatus, e.g. in the wedge
2224/77283 . . . by infrared heating, e.g. infrared heating lamp
2224/773 . . . by means of pressure
2224/77313 . . . Wedge
2224/77314 . . . Shape
2224/77315 . . . of the pressing surface, e.g. tip or head
2224/77316 . . . comprising protrusions
2224/77317 . . . of other portions
2224/77318 . . . inside the capillary
2224/77319 . . . outside the capillary
2224/7732 . . . Removable wedge
2224/77321 . . . Material
2224/77325 . . . Auxiliary members on the pressing surface
2224/77326 . . . Removable auxiliary member
2224/77327 . . . Shape of the auxiliary member
2224/77328 . . . Material of the auxiliary member
2224/77343 . . . by ultrasonic vibrations
2224/77344 . . . Eccentric cams
2224/77345 . . . in the lower part of the bonding apparatus, e.g. in the apparatus chuck
2224/77346 . . . in the upper part of the bonding apparatus, e.g. in the wedge
2224/77347 . . . Piezoelectric transducers
2224/77348 . . . in the lower part of the bonding apparatus, e.g. in the apparatus chuck
2224/77349 . . . in the upper part of the bonding apparatus, e.g. in the wedge
2224/7735 . . . Stable and mobile yokes
2224/77351 . . . in the lower part of the bonding apparatus, e.g. in the apparatus chuck
2224/77352 . . . in the upper part of the bonding apparatus, e.g. in the wedge
2224/77353 . . . Ultrasonic horns
2224/77354 . . . in the lower part of the bonding apparatus, e.g. in the mounting chuck
2224/77355 . . . Design, e.g. of the wave guide
2224/776 . . . Means for supplying the connector to be connected in the bonding apparatus
2224/77601 . . . Storing means
2224/77611 . . . Feeding means
2224/77621 . . . Holding means, e.g. wire clampers
2224/77631 . . . Means for wire tension adjustments
2224/7765 . . . Means for transporting the components to be connected
2224/77651 . . . Belt conveyor
2224/77652 . . . Chain conveyor
2224/77653 . . . Vibrating conveyor
2224/77654 . . . Pneumatic conveyor
2224/77655 . . . in a fluid
2224/777 . . . Means for aligning
2224/77701 . . . in the lower part of the bonding apparatus, e.g. in the apparatus chuck
2224/77702 . . . in the upper part of the bonding apparatus, e.g. in the wedge
2224/77703 . . . Mechanical holding means
2224/77704 . . . in the lower part of the bonding apparatus, e.g. in the apparatus chuck
2224/77705 . . . in the upper part of the bonding apparatus, e.g. in the wedge
2224/77723 . . . Electrostatic holding means
2224/77724 . . . in the lower part of the bonding apparatus, e.g. in the apparatus chuck
2224/77725 . . . in the upper part of the bonding apparatus, e.g. in the wedge
2224/77733 . . . Magnetic holding means
2224/77734 . . . in the lower part of the bonding apparatus, e.g. in the apparatus chuck
2224/77735 . . . in the upper part of the bonding apparatus, e.g. in the wedge
2224/77743 . . . Suction holding means
2224/77744 . . . in the lower part of the bonding apparatus, e.g. in the apparatus chuck
2224/77745 . . . in the upper part of the bonding apparatus, e.g. in the wedge
2224/77753 . . . Means for optical alignment, e.g. sensors
2224/77754 . . . Guiding structures
2224/77755 . . . in the lower part of the bonding apparatus, e.g. in the apparatus chuck
2224/77756 . . . in the upper part of the bonding apparatus, e.g. in the wedge
2224/7778 . . . Means for moving parts
2224/77801 . . . Lower part of the bonding apparatus, e.g. XY table
2224/77802 . . . Rotational mechanism
2224/77803 . . . Pivoting mechanism
2224/77804 . . . Translational mechanism
2224/77821 . . . Upper part of the bonding apparatus, i.e. bonding head, e.g. capillary or wedge
2224/77822 . . . Rotational mechanism
2224/77823 . . . Pivoting mechanism
2224/77824 . . . Translational mechanism
2224/77841 . . . of the pressing portion, e.g. tip or head
2224/77842 . . . Rotational mechanism
2224/77843 . . . Pivoting mechanism
2224/779 . . . Means for monitoring the connection process
2224/77901 . . . using a computer, e.g. fully- or semi-automatic bonding
2224/7792 . . . Load or pressure adjusting means, e.g. sensors
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2224/77925</td>
<td>Vibration adjusting means, e.g. sensors</td>
</tr>
<tr>
<td>2224/7795</td>
<td>Means for forming additional members</td>
</tr>
<tr>
<td>2224/7798</td>
<td>specially adapted for batch processes</td>
</tr>
<tr>
<td>2224/77981</td>
<td>Apparatus chuck</td>
</tr>
<tr>
<td>2224/77982</td>
<td>Shape</td>
</tr>
<tr>
<td>2224/77983</td>
<td>of the mounting surface</td>
</tr>
<tr>
<td>2224/77984</td>
<td>of other portions</td>
</tr>
<tr>
<td>2224/77985</td>
<td>Material</td>
</tr>
<tr>
<td>2224/77986</td>
<td>Auxiliary members on the pressing surface</td>
</tr>
<tr>
<td>2224/77987</td>
<td>Shape of the auxiliary member</td>
</tr>
<tr>
<td>2224/77988</td>
<td>Material of the auxiliary member</td>
</tr>
<tr>
<td>2224/78</td>
<td>Apparatus for connecting with wire connectors</td>
</tr>
<tr>
<td>2224/78001</td>
<td>Calibration means</td>
</tr>
<tr>
<td>2224/7801</td>
<td>Means for cleaning, e.g. brushes, for hydroblasting, for ultrasonic cleaning, for dry ice blasting, using gas-flow, by etching, by applying flux or plasma</td>
</tr>
<tr>
<td>2224/781</td>
<td>Means for controlling the bonding environment, e.g. valves, vacuum pumps</td>
</tr>
<tr>
<td>2224/78101</td>
<td>Chamber</td>
</tr>
<tr>
<td>2224/78102</td>
<td>Vacuum chamber</td>
</tr>
<tr>
<td>2224/7811</td>
<td>High pressure chamber</td>
</tr>
<tr>
<td>2224/7815</td>
<td>Means for applying permanent coating, e.g. in-situ coating</td>
</tr>
<tr>
<td>2224/782</td>
<td>Protection means against electrical discharge</td>
</tr>
<tr>
<td>2224/7825</td>
<td>Means for applying energy, e.g. heating means</td>
</tr>
<tr>
<td>2224/78251</td>
<td>in the lower part of the bonding apparatus, e.g. in the apparatus chuck</td>
</tr>
<tr>
<td>2224/78252</td>
<td>in the upper part of the bonding apparatus, e.g. in the capillary or wedge</td>
</tr>
<tr>
<td>2224/78253</td>
<td>adapted for localised heating</td>
</tr>
<tr>
<td>2224/7826</td>
<td>Polychromatic heating lamp</td>
</tr>
<tr>
<td>2224/78261</td>
<td>Laser</td>
</tr>
<tr>
<td>2224/78262</td>
<td>in the lower part of the bonding apparatus, e.g. in the apparatus chuck</td>
</tr>
<tr>
<td>2224/78263</td>
<td>in the upper part of the bonding apparatus, e.g. in the capillary or wedge</td>
</tr>
<tr>
<td>2224/78264</td>
<td>by induction heating, i.e. coils</td>
</tr>
<tr>
<td>2224/78265</td>
<td>in the lower part of the bonding apparatus, e.g. in the apparatus chuck</td>
</tr>
<tr>
<td>2224/78266</td>
<td>in the upper part of the bonding apparatus, e.g. in the capillary or wedge</td>
</tr>
<tr>
<td>2224/78267</td>
<td>Flame torch, e.g. hydrogen torch</td>
</tr>
<tr>
<td>2224/78268</td>
<td>Discharge electrode</td>
</tr>
<tr>
<td>2224/78269</td>
<td>Shape of the discharge electrode</td>
</tr>
<tr>
<td>2224/7827</td>
<td>Material of the discharge electrode</td>
</tr>
<tr>
<td>2224/78271</td>
<td>Circuitry of the discharge electrode</td>
</tr>
<tr>
<td>2224/78272</td>
<td>Oven</td>
</tr>
<tr>
<td>2224/7828</td>
<td>Resistance welding electrodes, i.e. for ohmic heating</td>
</tr>
<tr>
<td>2224/78281</td>
<td>in the lower part of the bonding apparatus, e.g. in the apparatus chuck</td>
</tr>
<tr>
<td>2224/78282</td>
<td>in the upper part of the bonding apparatus, e.g. in the capillary or wedge</td>
</tr>
<tr>
<td>2224/78283</td>
<td>by infrared heating, e.g. infrared heating lamp</td>
</tr>
<tr>
<td>2224/783</td>
<td>by means of pressure</td>
</tr>
<tr>
<td>2224/78301</td>
<td>Capillary</td>
</tr>
<tr>
<td>2224/78302</td>
<td>Shape</td>
</tr>
<tr>
<td>2224/78303</td>
<td>of the pressing surface, e.g. tip or head</td>
</tr>
<tr>
<td>2224/78304</td>
<td>comprising protrusions</td>
</tr>
<tr>
<td>2224/78305</td>
<td>of other portions</td>
</tr>
<tr>
<td>2224/78306</td>
<td>inside the capillary</td>
</tr>
<tr>
<td>2224/78307</td>
<td>outside the capillary</td>
</tr>
<tr>
<td>2224/78308</td>
<td>Removable capillary</td>
</tr>
<tr>
<td>2224/78309</td>
<td>Material</td>
</tr>
<tr>
<td>2224/7831</td>
<td>Auxiliary members on the pressing surface</td>
</tr>
<tr>
<td>2224/78311</td>
<td>Removable auxiliary member</td>
</tr>
<tr>
<td>2224/78312</td>
<td>Shape of the auxiliary member</td>
</tr>
<tr>
<td>2224/78313</td>
<td>Wedge</td>
</tr>
<tr>
<td>2224/78314</td>
<td>Shape</td>
</tr>
<tr>
<td>2224/78315</td>
<td>of the pressing surface, e.g. tip or head</td>
</tr>
<tr>
<td>2224/78316</td>
<td>comprising protrusions</td>
</tr>
<tr>
<td>2224/78317</td>
<td>of other portions</td>
</tr>
<tr>
<td>2224/78318</td>
<td>inside the capillary</td>
</tr>
<tr>
<td>2224/78319</td>
<td>outside the capillary</td>
</tr>
<tr>
<td>2224/7832</td>
<td>Removable wedge</td>
</tr>
<tr>
<td>2224/78321</td>
<td>Material</td>
</tr>
<tr>
<td>2224/78325</td>
<td>Auxiliary members on the pressing surface</td>
</tr>
<tr>
<td>2224/78326</td>
<td>Removable auxiliary member</td>
</tr>
<tr>
<td>2224/78327</td>
<td>Shape of the auxiliary member</td>
</tr>
<tr>
<td>2224/78328</td>
<td>Material of the auxiliary member</td>
</tr>
<tr>
<td>2224/78343</td>
<td>by ultrasonic vibrations</td>
</tr>
<tr>
<td>2224/78344</td>
<td>Eccentric cams</td>
</tr>
<tr>
<td>2224/78345</td>
<td>in the lower part of the bonding apparatus, e.g. in the apparatus chuck</td>
</tr>
<tr>
<td>2224/78346</td>
<td>in the upper part of the bonding apparatus, e.g. in the capillary or wedge</td>
</tr>
<tr>
<td>2224/78347</td>
<td>Piezoelectric transducers</td>
</tr>
<tr>
<td>2224/78348</td>
<td>in the lower part of the bonding apparatus, e.g. in the apparatus chuck</td>
</tr>
<tr>
<td>2224/78349</td>
<td>in the upper part of the bonding apparatus, e.g. in the capillary or wedge</td>
</tr>
<tr>
<td>2224/7835</td>
<td>Stable and mobile yokes</td>
</tr>
<tr>
<td>2224/78351</td>
<td>in the lower part of the bonding apparatus, e.g. in the apparatus chuck</td>
</tr>
<tr>
<td>2224/78352</td>
<td>in the upper part of the bonding apparatus, e.g. in the capillary or wedge</td>
</tr>
<tr>
<td>2224/78353</td>
<td>Ultrasonic horns</td>
</tr>
<tr>
<td>2224/78354</td>
<td>in the lower part of the bonding apparatus, e.g. in the mounting chuck</td>
</tr>
<tr>
<td>2224/78355</td>
<td>Design, e.g. of the wave guide</td>
</tr>
<tr>
<td>2224/785</td>
<td>Cooling means</td>
</tr>
<tr>
<td>2224/78501</td>
<td>in the lower part of the bonding apparatus, e.g. in the apparatus chuck</td>
</tr>
<tr>
<td>2224/78502</td>
<td>in the upper part of the bonding apparatus, e.g. in the capillary or wedge</td>
</tr>
<tr>
<td>2224/7855</td>
<td>Mechanical means, e.g. for severing, pressing, stamping</td>
</tr>
<tr>
<td>2224/786</td>
<td>Means for supplying the connector to be connected in the bonding apparatus</td>
</tr>
<tr>
<td>2224/78601</td>
<td>Storing means</td>
</tr>
<tr>
<td>2224/7861</td>
<td>Feeding means</td>
</tr>
<tr>
<td>2224/78621</td>
<td>Holding means, e.g. wire clamps</td>
</tr>
<tr>
<td>2224/78631</td>
<td>Means for wire tension adjustments</td>
</tr>
<tr>
<td>2224/7865</td>
<td>Means for transporting the components to be connected</td>
</tr>
<tr>
<td>2224/78651</td>
<td>Belt conveyor</td>
</tr>
<tr>
<td>2224/78652</td>
<td>Chain conveyor</td>
</tr>
</tbody>
</table>
Apparatus chuck

Means for forming additional members

Means for aligning

Vibration adjusting means, e.g. sensors

Load or pressure adjusting means, e.g. automatic bonding using a computer, e.g. fully- or semi-bonding head, e.g. capillary or wedge

Upper part of the bonding apparatus, i.e. table

Lower part of the bonding apparatus, e.g. XY guiding structures

Means for blanket deposition

Means for applying a preform, e.g. laminator

Oven

Flame torch, e.g. hydrogen torch

Polychromatic heating lamp

Circuitry of the discharge electrode

Material of the discharge electrode

Shape of the discharge electrode
Means for aligning connected components to be bonded, e.g. in the pressing head

Means for transporting the components to be connected in the bonding apparatus, e.g. in the apparatus chuck

Means for supplying the connector to be connected, e.g. in the pressing head

Means for forming additional members, e.g. in the pressing head

Feeding means in the lower part of the bonding apparatus, e.g. in the apparatus chuck

Storing means in the upper part of the bonding apparatus, e.g. in the apparatus chuck

Means for forming additional members, e.g. in the apparatus chuck

Means for forming additional members, e.g. in the apparatus chuck

Eccentric cams

Piezoelectric transducers

in the upper part of the bonding apparatus, e.g. in the apparatus chuck

in the lower part of the bonding apparatus, e.g. in the apparatus chuck

Stable and mobile yokes

in the lower part of the bonding apparatus, e.g. in the apparatus chuck

in the upper part of the bonding apparatus, e.g. in the apparatus chuck

Ultrasonic horns

in the lower part of the bonding apparatus, e.g. in the apparatus chuck

Design, e.g. of the wave guide

Cooling means

in the lower part of the bonding apparatus, e.g. in the apparatus chuck

in the upper part of the bonding apparatus, e.g. in the apparatus chuck

Mechanical means, e.g. for pressing, stamping

in the lower part of the bonding apparatus, e.g. in the apparatus chuck

Means for supplying the connector to be connected in the bonding apparatus

Storing means

Feeding means

Holding means

Means for transporting the components to be connected

Belt conveyor

Chain conveyor

Vibrating conveyor

Pneumatic conveyor

in a fluid

Means for aligning

in the lower part of the bonding apparatus, e.g. in the apparatus chuck

in the upper part of the bonding apparatus, e.g. in the pressing head

Mechanical holding means

in the lower part of the bonding apparatus, e.g. in the apparatus chuck

in the upper part of the bonding apparatus, e.g. in the pressing head

Electrostatic holding means

in the lower part of the bonding apparatus, e.g. in the apparatus chuck

in the upper part of the bonding apparatus, e.g. in the pressing head

Magnetic holding means

in the lower part of the bonding apparatus, e.g. in the apparatus chuck

in the upper part of the bonding apparatus, e.g. in the pressing head

Suction holding means

in the lower part of the bonding apparatus, e.g. in the apparatus chuck

in the upper part of the bonding apparatus, i.e. pressing head

Rotational mechanism

Pivoting mechanism

Translational mechanism

of the pressing head

Rotational mechanism

Pivoting mechanism

Means for monitoring the connection process

using a computer, e.g. fully- or semi-automatic bonding

Load or pressure adjusting means, e.g. sensors

Vibration adjusting means, e.g. sensors

Means for forming additional members

specialty adapted for batch processes

Apparatus chuck

Shape

of the mounting surface

of other portions

Material

Auxiliary members on the pressing surface

Shape of the auxiliary member

Material of the auxiliary member

by ultrasonic vibrations

by means of pressure

Pressing head

Shape

of the pressing surface

comprising protrusions

of other parts

Removable pressing head

Auxiliary members on the pressing surface

Elastomer inlay

with retaining mechanisms

Removable auxiliary member

Shape of the auxiliary member

Material of the auxiliary member

Means for forming additional members, e.g. sensors

Automatic bonding using a computer, e.g. fully- or semi-automatic bonding

Translational mechanism

Translational mechanism

Means for forming additional members, e.g. sensors

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
by connecting a bonding area directly to another bonding area, i.e. connectless bonding, e.g. bumpless bonding

involved in a temporary auxiliary member not forming part of the bonding apparatus

being a removable or sacrificial coating

being a temporary or sacrificial substrate

involving a permanent auxiliary member being left in the finished device, e.g. aids for protecting the bonding area during or after the bonding process

Pre-treatment of the bonding area

Cleaning the bonding area, e.g. oxide removal step, desmearing

Chemical cleaning, e.g. etching, flux

Mechanical cleaning, e.g. abrasion using hydro blasting, brushes, ultrasonic cleaning, dry ice blasting, gas-flow

Plasma cleaning

Thermal cleaning, e.g. decomposition, sublimation

Combinations of two or more cleaning methods provided for in at least two different groups from H01L 2224/8001 - H01L 2224/8014

Applying permanent coating to the bonding area in the bonding apparatus, e.g. in-situ coating

Applying flux to the bonding area in the bonding apparatus

Reshaping the bonding area in the bonding apparatus, e.g. flattening the bonding area by chemical means, e.g. etching, anodisation

by heating means

using a polychromatic heating lamp

using a laser

Induction heating, i.e. eddy currents

by mechanical means, e.g. severing, pressing, stamping

Thermal treatments, e.g. annealing, controlled pre-heating or pre-cooling

Forming additional members

1. Detaching bonding areas, e.g. after testing (unsoldering in general B23K 1/018)

2. Bonding environment

3. Composition of the atmosphere

4. being oxidating

5. being reducing

6. being inert

7. being a liquid, e.g. for fluidic self-assembly

8. Vacuum

9. Under pressure

10. Atmospheric pressure

11. Transient conditions, e.g. gas-flow

12. Temperature settings

13. Transient conditions

14. Heating

15. Cooling

16. Ambient temperature

17. involving protection against electrical discharge, e.g. removing electrostatic charge

18. Aligning

Active alignment, i.e. by apparatus steering, e.g. optical alignment using marks or sensors by detecting inherent features of, or outside, the semiconductor or solid-state body

Shape or position of the body

Bonding areas on the body

Bonding areas outside the body

Shape or position of the other item

using marks formed on the semiconductor or solid-state body

using marks formed outside the semiconductor or solid-state body, i.e. "off-chip"

involving guiding structures, e.g. spacers or supporting members

the guiding structures being at least partially left in the finished device

Guiding structures on the body

Guiding structures outside the body

Guiding structures both on and outside the body

Passive alignment, i.e. self-alignment, e.g. using surface energy, chemical reactions, thermal equilibrium

being movement of a part of the bonding apparatus

being the lower part of the bonding apparatus, i.e. holding means for the bodies to be connected, e.g. XY table

Rotational movements

Translational movements

Arrangement of the bonding areas prior to mounting

Lateral distribution of the bonding areas

Applying energy for connecting

Compression bonding

Thermocompression bonding, e.g. diffusion bonding, pressure joining, thermocompression welding or solid-state welding

with a graded temperature profile

Ultrasonic bonding

Direction of oscillation

Thermosonic bonding

applying unidirectional static pressure

applying isostatic pressure, e.g. degassing using vacuum or a pressurised liquid

using a reflow oven

with a graded temperature profile

with energy being in the form of electromagnetic radiation

Induction heating, i.e. eddy currents

using a laser

Polychromatic or infrared lamp heating

using an autocatalytic reaction, e.g. exothermic brazing

using means for applying energy being within the device, e.g. integrated heater
Bonding interfaces outside the semiconductor solid state body

Material: having an external coating, e.g. protective bond-through coating

Material being flush with the surface having an external coating, e.g. protective bond-through coating

Material (material of the bonding area prior to the connecting process H01L 2224/0599 and H01L 2224/05599)

Bonding interfaces outside the semiconductor or solid-state body

Material: with a principal constituent of the material being a metal or a metalloid, e.g. boron \([B]\), silicon \([Si]\), germanium \([Ge]\), arsenic \([As]\), antimony \([Sb]\), tellurium \([Te]\) and polonium \([Po]\), and alloys thereof

the principal constituent melting at a temperature of less than 400°C

gallium \([Ga]\) as principal constituent

indium \([In]\) as principal constituent

tin \([Sn]\) as principal constituent

bismuth \([Bi]\) as principal constituent

thallium \([Tl]\) as principal constituent

lead \([Pb]\) as principal constituent

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

zinc \([Zn]\) as principal constituent

antimony \([Sb]\) as principal constituent

magnesium \([Mg]\) as principal constituent

aluminium \([Al]\) as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

silver \([Ag]\) as principal constituent

gold \([Au]\) as principal constituent

copper \([Cu]\) as principal constituent

manganese \([Mn]\) as principal constituent

nickel \([Ni]\) as principal constituent

cobalt \([Co]\) as principal constituent

iron \([Fe]\) as principal constituent

the principal constituent melting at a temperature of greater than 1550°C

palladium \([Pd]\) as principal constituent

titanium \([Ti]\) as principal constituent

platinum \([Pt]\) as principal constituent

zirconium \([Zr]\) as principal constituent

chromium \([Cr]\) as principal constituent

vanadium \([V]\) as principal constituent

rhodium \([Rh]\) as principal constituent

ruthenium \([Ru]\) as principal constituent

iridium \([Ir]\) as principal constituent

niobium \([Nb]\) as principal constituent

molybdenum \([Mo]\) as principal constituent

tantalum \([Ta]\) as principal constituent

rhenium \([Re]\) as principal constituent

tungsten \([W]\) as principal constituent

with a principal constituent of the material being a non metallic, non metalloid inorganic material

ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/0848)
glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

the principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2224/0804 - H01L 2224/8049, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/0804 - H01L 2224/8049

with a principal constituent of the material being a gas not provided for in groups H01L 2224/0804 - H01L 2224/8049

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

material of the matrix
metalloid inorganic material with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof, at a temperature of greater than 400°C or equal to 950°C and less than 1550°C.

- Thallium [Tl] as principal constituent
- Lead [Pb] as principal constituent
- the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
- Zinc [Zn] as principal constituent
- Antimony [Sb] as principal constituent
- Magnesium [Mg] as principal constituent
- Aluminium [Al] as principal constituent
- the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
- Silver [Ag] as principal constituent
- Gold [Au] as principal constituent
- Copper [Cu] as principal constituent
- Manganese [Mn] as principal constituent
- Nickel [Ni] as principal constituent
- Cobalt [Co] as principal constituent
- Iron [Fe] as principal constituent
- the principal constituent melting at a temperature of greater than 1550°C
- Palladium [Pd] as principal constituent
- Titanium [Ti] as principal constituent
- Platinum [Pt] as principal constituent
- Zirconium [Zr] as principal constituent
- Chromium [Cr] as principal constituent
- Vanadium [V] as principal constituent
- Rhodium [Rh] as principal constituent
- Ruthenium [Ru] as principal constituent
- Iridium [Ir] as principal constituent
- Niobium [Nb] as principal constituent
- Molybdenum [Mo] as principal constituent
- Tantalum [Ta] as principal constituent
- Rhenium [Re] as principal constituent
- Tungsten [W] as principal constituent
- with a principal constituent of the material being a non metallic, non metalloid inorganic material

- Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics)
- Glasses, e.g. amorphous oxides, nitrides or fluorides
- with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy
- The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene
- with a principal constituent of the material being a solid not provided for in groups H01L 2224/805 - H01L 2224/80591, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
- with a principal constituent of the material being a liquid not provided for in groups H01L 2224/805 - H01L 2224/80591
- with a principal constituent of the material being a gas not provided for in groups H01L 2224/805 - H01L 2224/80591
- Fillers
- Base material
- with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof, at a temperature of less than 400°C
- Gallium [Ga] as principal constituent
- Indium [In] as principal constituent
- Tin [Sn] as principal constituent
- Bismuth [Bi] as principal constituent
- Thallium [Tl] as principal constituent
- Lead [Pb] as principal constituent
- the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
- Zinc [Zn] as principal constituent
- Antimony [Sb] as principal constituent
- Magnesium [Mg] as principal constituent
- Aluminium [Al] as principal constituent
- the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
Silver [Ag] as principal constituent
Gold [Au] as principal constituent
Copper [Cu] as principal constituent
Manganese [Mn] as principal constituent
Nickel [Ni] as principal constituent
Cobalt [Co] as principal constituent
Iron [Fe] as principal constituent
the principal constituent melting at a temperature of greater than 1550°C
Palladium [Pd] as principal constituent
Titanium [Ti] as principal constituent
Platinum [Pt] as principal constituent
Zirconium [Zr] as principal constituent
Chromium [Cr] as principal constituent
Vanadium [V] as principal constituent
Rhodium [Rh] as principal constituent
Ruthenium [Ru] as principal constituent
Iridium [Ir] as principal constituent
Niobium [Nb] as principal constituent
Molybdenum [Mo] as principal constituent
Tantalum [Ta] as principal constituent
Tungsten [W] as principal constituent
with a principal constituent of the material being a non metallic, non metalloid inorganic material
Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/80688)
Glasses, e.g. amorphous oxides, nitrides or fluorides
with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy
The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene
with a principal constituent of the material being a solid not provided for in groups H01L 2224/806 - H01L 2224/80691, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
with a principal constituent of the material being a liquid not provided for in groups H01L 2224/806 - H01L 2224/80691
with a principal constituent of the material being a gas not provided for in groups H01L 2224/806 - H01L 2224/80691
with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams
Coating material
with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof
the principal constituent melting at a temperature of less than 400°C
Gallium [Ga] as principal constituent
Indium [In] as principal constituent
Tin [Sn] as principal constituent
Bismuth [Bi] as principal constituent
Thallium [Tl] as principal constituent
Lead [Pb] as principal constituent
the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
Zinc [Zn] as principal constituent
Antimony [Sb] as principal constituent
Magnesium [Mg] as principal constituent
Aluminium [Al] as principal constituent
the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
Silver [Ag] as principal constituent
Gold [Au] as principal constituent
Copper [Cu] as principal constituent
Manganese [Mn] as principal constituent
Nickel [Ni] as principal constituent
Cobalt [Co] as principal constituent
Iron [Fe] as principal constituent
the principal constituent melting at a temperature of greater than 1550°C
Palladium [Pd] as principal constituent
Titanium [Ti] as principal constituent
Platinum [Pt] as principal constituent
Zirconium [Zr] as principal constituent
Chromium [Cr] as principal constituent
Vanadium [V] as principal constituent
Rhodium [Rh] as principal constituent
Ruthenium [Ru] as principal constituent
Iridium [Ir] as principal constituent
Niobium [Nb] as principal constituent
Molybdenum [Mo] as principal constituent
Tantalum [Ta] as principal constituent
Rhenium [Re] as principal constituent
Tungsten [W] as principal constituent
with a principal constituent of the material being a non metallic, non metalloid inorganic material
Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/80788)
Glasses, e.g. amorphous oxides, nitrides or fluorides
with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy
The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene
with a principal constituent of the material being a solid not provided for in groups H01L 2224/8085 - H01L 2224/8089, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
with a principal constituent of the material being a liquid not provided for in groups H01L 2224/8085 - H01L 2224/8089
with a principal constituent of the material being a gas not provided for in groups H01L 2224/807 - H01L 2224/8079
with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams
Shape or distribution of the fillers
Bonding techniques
Soldering or alloying
involving forming a eutectic alloy at the bonding interface
involving forming an intermetallic compound at the bonding interface
Reflow soldering
Diffusion bonding
Solid-liquid interdiffusion
Solid-solid interdiffusion
Sintering
using a polymer adhesive, e.g. an adhesive based on silicone, epoxy, polyimide, polyester
Hardening the adhesive by curing, i.e. thermosetting
Pre-cured adhesive, i.e. B-stage adhesive
Localised curing of parts of the bonding area
Heat curing
Microwave curing
Infrared [IR] curing
Visible light curing
Ultraviolet [UV] curing
Moisture curing, i.e. curing by exposing to humidity, e.g. for silicones and polyurethanes
Hardening the adhesive by cooling, e.g. for thermoplastics or hot-melt adhesives
Combinations of two or more hardening methods provided for in at least two different groups from H01L 2224/8085 - H01L 2224/8088, e.g. for hybrid thermoplastic-thermosetting adhesives
using an inorganic non metallic glass type adhesive, e.g. solder glass
Anodic bonding, i.e. bonding by applying a voltage across the interface in order to induce ions migration leading to an irreversible chemical bond
Direct bonding, i.e. joining surfaces by means of intermolecular attracting interactions at their interfaces, e.g. covalent bonds, van der Waals forces
between electrically conductive surfaces, e.g. copper-copper direct bonding, surface activated bonding
between electrically insulating surfaces, e.g. oxide or nitride layers
Mechanical interlocking, e.g. anchoring, hook and loop-type fastening or the like
null
by detecting inherent features of, or outside, the semiconductor or solid-state body

Shape or position of the body

Bonding areas on the body

Bonding areas outside the body

Shape or position of the other item

using marks formed on the semiconductor or solid-state body

using marks formed outside the semiconductor or solid-state body, i.e. “off-chip”

involving guiding structures, e.g. spacers or supporting members

the guiding structures being at least partially left in the finished device

Guiding structures on the body

Guiding structures outside the body

Guiding structures both on and outside the body

Passive alignment, i.e. self alignment, e.g. using surface energy, chemical reactions, thermal equilibrium

involving movement of a part of the bonding apparatus

being the lower part of the bonding apparatus, i.e. holding means for the bodies to be connected, e.g. XY table

Rotational movements

Translational movements

being the upper part of the bonding apparatus, i.e. bonding head

Rotational movements

Translational movements

Arrangement of the bump connectors prior to mounting

wherein the bump connectors are disposed only on the semiconductor or solid-state body

wherein the bump connectors are disposed only on another item or body to be connected to the semiconductor or solid-state body

wherein the bump connectors are disposed on both the semiconductor or solid-state body and another item or body to be connected to the semiconductor or solid-state body

Lateral distribution of the bump connectors

Applying energy for connecting

Compression bonding

Thermocompression bonding, e.g. diffusion bonding, pressure joining, thermocompression welding or solid-state welding

with a graded temperature profile

Ultrasonic bonding

Direction of oscillation

Thermosonic bonding

applying unidirectional static pressure

applying isostatic pressure, e.g. degassing using vacuum or a pressurised liquid

using a reflow oven

with a graded temperature profile

with energy being in the form of electromagnetic radiation

Induction heating, i.e. eddy currents

using a laser

Polychromatic or infrared lamp heating

using an autocatalytic reaction, e.g. exothermic brazing

using means for applying energy being within the device, e.g. integrated heater

using electro-static corona discharge

using an electron beam (electron beam welding in general B23K 15/00)

using electric resistance welding, i.e. ohmic heating

Bonding interfaces of the bump connector

Shape, e.g. interlocking features

having an external coating, e.g. protective bond-through coating

Material

Bonding interfaces of the semiconductor or solid state body

Shape, e.g. interlocking features

having an external coating, e.g. protective bond-through coating

Material (material of the bump connector prior to the connecting process H01L 2224/13099 and H01L 2224/13599 and subgroups)

Bonding interfaces outside the semiconductor or solid-state body

Shape, e.g. interlocking features

having an external coating, e.g. protective bond-through coating

Material

with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

the principal constituent melting at a temperature of less than 400°C

Gallium [Ga] as principal constituent

Indium [In] as principal constituent

Tin [Sn] as principal constituent

Bismuth [Bi] as principal constituent

Thallium [Tl] as principal constituent

Lead [Pb] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc [Zn] as principal constituent

Antimony [Sb] as principal constituent

Magnesium [Mg] as principal constituent

Aluminium [Al] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Silver [Ag] as principal constituent

Gold [Au] as principal constituent

Copper [Cu] as principal constituent
2224/81449     Manganese [Mn] as principal constituent
2224/81455     Nickel [Ni] as principal constituent
2224/81457     Cobalt [Co] as principal constituent
2224/81463     Iron [Fe] as principal constituent
2224/81464     the principal constituent melting at a temperature of greater than 1550°C
2224/81466     Palladium [Pd] as principal constituent
2224/81469     Titanium [Ti] as principal constituent
2224/81471     Chromium [Cr] as principal constituent
2224/81472     Vanadium [V] as principal constituent
2224/81473     Rhodium [Rh] as principal constituent
2224/81476     Ruthenium [Ru] as principal constituent
2224/81478     Iridium [Ir] as principal constituent
2224/81479     Niobium [Nb] as principal constituent
2224/8148       Molybdenum [Mo] as principal constituent
2224/81481     Tantalum [Ta] as principal constituent
2224/81483     Rhenium [Re] as principal constituent
2224/81484     Tungsten [W] as principal constituent
2224/81486     with a principal constituent of the material being a solid not provided for in groups H01L 2224/81491, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
2224/81487     Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/81488)
2224/81488     Glasses, e.g. amorphous oxides, nitrides or fluorides
2224/8149     with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy
2224/81491     The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene
2224/81493     with a principal constituent of the material being a solid not provided for in groups H01L 2224/81491, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
2224/81494     with a principal constituent of the material being a liquid not provided for in groups H01L 2224/81491 - H01L 2224/81491
2224/81495     with a principal constituent of the material being a gas not provided for in groups H01L 2224/81491 - H01L 2224/81491
2224/81498     with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams
2224/81499     Material of the matrix
2224/815     with a principal constituent of the material being a metal or a metallicloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof
2224/81501     the principal constituent melting at a temperature of less than 400°C
2224/81505     Gallium [Ga] as principal constituent
2224/81509     Indium [In] as principal constituent
2224/81511     Tin [Sn] as principal constituent
2224/81513     Bismuth [Bi] as principal constituent
2224/81514     Thallium [Tl] as principal constituent
2224/81516     Lead [Pb] as principal constituent
2224/81517     the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
2224/81518     Zinc [Zn] as principal constituent
2224/8152     Antimony [Sb] as principal constituent
2224/81523     Magnesium [Mg] as principal constituent
2224/81524     Aluminium [Al] as principal constituent
2224/81538     the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
2224/81539     Silver [Ag] as principal constituent
2224/81544     Gold [Au] as principal constituent
2224/81547     Copper [Cu] as principal constituent
2224/81549     Manganese [Mn] as principal constituent
2224/81555     Nickel [Ni] as principal constituent
2224/81557     Cobalt [Co] as principal constituent
2224/8156     Iron [Fe] as principal constituent
2224/81563     the principal constituent melting at a temperature of greater than 1550°C
2224/81564     Palladium [Pd] as principal constituent
2224/81566     Titanium [Ti] as principal constituent
2224/81569     Platinum [Pt] as principal constituent
2224/8157     Zirconium [Zr] as principal constituent
2224/81571     Chromium [Cr] as principal constituent
2224/81572     Vanadium [V] as principal constituent
2224/81573     Rhodium [Rh] as principal constituent
2224/81576     Ruthenium [Ru] as principal constituent
2224/81578     Iridium [Ir] as principal constituent
2224/81579     Niobium [Nb] as principal constituent
2224/8158     Molybdenum [Mo] as principal constituent

Material of the matrix.
Fillers

Base material

with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

the principal constituent melting at a temperature of less than 400°C

Gallium [Ga] as principal constituent

Indium [In] as principal constituent

Tin [Sn] as principal constituent

Bismuth [Bi] as principal constituent

Thallium [Tl] as principal constituent

Lead [Pb] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc [Zn] as principal constituent

Antimony [Sb] as principal constituent

Magnesium [Mg] as principal constituent

Aluminium [Al] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Silver [Ag] as principal constituent

Gold [Au] as principal constituent

Copper [Cu] as principal constituent

Manganese [Mn] as principal constituent

Nickel [Ni] as principal constituent

Cobalt [Co] as principal constituent

Iron [Fe] as principal constituent

the principal constituent melting at a temperature of greater than 1550°C

Palladium [Pd] as principal constituent

Titanium [Ti] as principal constituent

Platinum [Pt] as principal constituent

Zirconium [Zr] as principal constituent

Chromium [Cr] as principal constituent

Vanadium [V] as principal constituent

Rhodium [Rh] as principal constituent

Ruthenium [Ru] as principal constituent

Iridium [Ir] as principal constituent

Nobium [Nb] as principal constituent

Molybdenum [Mo] as principal constituent

Tantalum [Ta] as principal constituent

Rhenium [Re] as principal constituent

Tungsten [W] as principal constituent

with a principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/81588)

Glasses, e.g. amorphous oxides, nitrides or fluorides

H01L
Coating material

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2224/816 - H01L 2224/81691, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/816 - H01L 2224/81691

with a principal constituent of the material being a gas not provided for in groups H01L 2224/816 - H01L 2224/81691

Coating material

with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

the principal constituent melting at a temperature of less than 400°C

Gallium [Ga] as principal constituent

Indium [In] as principal constituent

Tin [Sn] as principal constituent

Bismuth [Bi] as principal constituent

Thallium [Tl] as principal constituent

Lead [Pb] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc [Zn] as principal constituent

Antimony [Sb] as principal constituent

Magnesium [Mg] as principal constituent

Aluminium [Al] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Silver [Ag] as principal constituent

Gold [Au] as principal constituent

Copper [Cu] as principal constituent

Manganese [Mn] as principal constituent

Nickel [Ni] as principal constituent

Cobalt [Co] as principal constituent

Iron [Fe] as principal constituent

the principal constituent melting at a temperature of greater than 1550°C

Palladium [Pd] as principal constituent

Titanium [Ti] as principal constituent

Platinum [Pt] as principal constituent

Zirconium [Zr] as principal constituent

Chromium [Cr] as principal constituent

Vanadium [V] as principal constituent

Rhodium [Rh] as principal constituent

Ruthenium [Ru] as principal constituent

Iridium [Ir] as principal constituent

Niobium [Nb] as principal constituent

Molybdenum [Mo] as principal constituent

Tantalum [Ta] as principal constituent

Rhenium [Re] as principal constituent

Tungsten [W] as principal constituent

with a principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/81788)

Glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene
Bonding techniques

- Reflow soldering
- Diffusion bonding
- Solid-liquid interdiffusion
- Solid-solid interdiffusion
- Sintering

Shape or distribution of the fillers

- Pre-cured adhesive, i.e. B-stage adhesive
- Localised curing of parts of the bump connector
- Heat curing
- Microwave curing
- Infrared [IR] curing
- Visible light curing
- Ultraviolet [UV] curing

Hardening the adhesive by curing, i.e. thermosetting

- Hardening the adhesive by cooling, e.g. for thermoplastics or hot-melt adhesives
- Combinations of two or more hardening methods provided for in at least two different groups from H01L 2224/8185 - H01L 2224/8188, e.g. for hybrid thermoplastic-thermosetting adhesives
- Using an inorganic non metallic glass type adhesive, e.g. solder glass
- Anodic bonding, i.e. bonding by applying a voltage across the interface in order to induce ions migration leading to an irreversible chemical bond

Direct bonding, i.e. joining surfaces by means of intermolecular attracting interactions at their interfaces, e.g. covalent bonds, van der Waals forces

between electrically conductive surfaces, e.g. copper-copper direct bonding, surface activated bonding

between electrically insulating surfaces, e.g. oxide or nitride layers

Mechanical interlocking, e.g. anchoring, hook and loop-type fastening or the like

Press-fitting, i.e. pushing the parts together and fastening by friction, e.g. by compression of one part against the other

using resilient parts in the bump connector or in the bonding area

with the bump connector not providing any mechanical bonding

Pressing the bump connector against the bonding areas by means of another connector (detachable pressure contact H01L 2224/72)

by means of another bump connector

by means of a layer connector

by means of an encapsulation layer or foil

Combinations of bonding methods provided for in at least two different groups from H01L 2224/818 - H01L 2224/81904

Specific sequence of method steps

Intermediate bonding, i.e. intermediate bonding step for temporarily bonding the semiconductor or solid-state body, followed by at least a further bonding step

involving monitoring, e.g. feedback loop

Post-treatment of the bump connector or bonding area

Cleaning, e.g. oxide removal step, desmearing

Chemical cleaning, e.g. etching, flux

Mechanical cleaning, e.g. abrasion using hydro blasting, brushes, ultrasonic cleaning, dry ice blasting, gas-flow

Plasma cleaning

Thermal cleaning, e.g. using laser ablation or by electrostatic corona discharge

Combinations of two or more cleaning methods provided for in at least two different groups from H01L 2224/8191 - H01L 2224/81914

Applying permanent coating, e.g. protective coating

Reshaping

by chemical means, e.g. etching

by heating means, e.g. reflowing

using a polychromatic heating lamp

using a laser

Induction heating, i.e. eddy currents

using a flame torch, e.g. hydrogen torch

using a corona discharge, e.g. electronic flame off [EFO]

by mechanical means, e.g. "pull-and-cut", pressing, stamping

Thermal treatments, e.g. annealing, controlled cooling
Forming additional members, e.g. for reinforcing

Specific sequence of steps, e.g. repetition of manufacturing steps, time sequence

by forming build-up interconnects at chip-level, e.g. for high density interconnects [HDI]

involving a temporary auxiliary member not forming part of the bonding apparatus

being a removable or sacrificial coating

being a temporary or sacrificial substrate

involving a permanent auxiliary member being left in the finished device, e.g. aids for holding or protecting a build-up interconnect during or after the bonding process

Pre-treatment of the connector or the bonding area

Cleaning, e.g. oxide removal step, desmearing

Reshaping, e.g. forming vias

by chemical means, e.g. etching, anodisation

by heating means

using a laser

using a corona discharge, e.g. electronic flame off [EFO]

by mechanical means, e.g. severing, pressing, stamping

Thermal treatments, e.g. annealing, controlled pre-heating or pre-cooling

Forming additional members

Bonding environment

Composition of the atmosphere

being a liquid, e.g. for fluidic self-assembly

Vacuum

Under pressure

Temperature settings

Transient conditions

Heating

Cooling

Ambient temperature

Forming a build-up interconnect

by additive methods, e.g. direct writing

by jetting, e.g. ink jet

by laser direct writing

by screen printing

by using a preform

by subtractive methods

by self-assembly processes

involving protection against electrical discharge, e.g. removing electrostatic charge

Aligning

Active alignment, i.e. by apparatus steering, e.g. optical alignment using marks or sensors

by detecting inherent features of, or outside, the semiconductor or solid-state body

using marks formed on the semiconductor or solid-state body

using marks formed outside the semiconductor or solid-state body, i.e. "off-chip"

involving guiding structures, e.g. spacers or supporting members

the guiding structures being at least partially left in the finished device

Passive alignment, i.e. self alignment, e.g. using surface energy, chemical reactions, thermal equilibrium

involving movement of a part of the bonding apparatus

being the lower part of the bonding apparatus, i.e. holding means for the bodies to be connected, e.g. XY table

Rotational movements

Translational movements

being the upper part of the bonding apparatus, e.g. nozzle

Rotational movement

Translational movements

connecting first on the semiconductor or solid-state body, i.e. on-chip,

connecting first outside the semiconductor or solid-state body, i.e. off-chip

connecting first both on and outside the semiconductor or solid-state body

Applying energy for connecting

Compression bonding

Thermocompression bonding

Ultrasonic bonding

Thermosonic bonding

with energy being in the form of electromagnetic radiation

Induction heating, i.e. eddy currents

using a laser

Polychromatic or infrared lamp heating

using an autocatalytic reaction, e.g. exothermic brazing

using means for applying energy being within the device, e.g. integrated heater

using electro-static corona discharge

using electron beam, (electron beam in general B23K 15/00)

using electric resistance welding, i.e. ohmic heating

Bonding interfaces of the connector

Shape, e.g. interlocking features

having an external coating, e.g. protective bond-through coating

Material

Bonding interfaces of the semiconductor or solid state body

Shape, e.g. interlocking features

having an external coating, e.g. protective bond-through coating

Material

Bonding interfaces outside the semiconductor or solid-state body

Shape, e.g. interlocking features

having an external coating, e.g. protective bond-through coating

Material

Bonding techniques

Soldering or alloying

involving forming a eutectic alloy at the bonding interface
Post-treatment of the connector or the bonding involving monitoring, e.g. feedback loop

Reshaping

Combinations of bonding methods provided

- \textbf{H01L 2224/82897} \\
interactions at their interfaces, e.g. covalent
by means of intermolecular attracting

Direct bonding, i.e. joining surfaces
chemical bond
ions migration leading to an irreversible
tension across the interface in order to induce

Anodic bonding, i.e. bonding by applying a
voltage across the interface in order to induce
ions migration leading to an irreversible
chemical bond

- \textbf{H01L 2224/82885} \\
Combinations of two or more
hardening methods provided for in
at least two different groups from
\textbf{H01L 2224/82855} - \textbf{H01L 2224/8288}, e.g.
for hybrid thermoplastic-thermosetting
adhesives

using an inorganic non metallic glass type
adhesive, e.g. solder glass

Anodic bonding, i.e. bonding by applying a
voltage across the interface in order to induce
ions migration leading to an irreversible
chemical bond

- \textbf{H01L 2224/82895} \\
Direct bonding, i.e. joining surfaces
by means of intermolecular attracting
interactions at their interfaces, e.g. covalent
bonds, van der Waals forces

between electrically conductive surfaces,
e.g. copper-copper direct bonding, surface
activated bonding

between electrically insulating surfaces,
e.g. oxide or nitride layers

- \textbf{H01L 2224/82899} \\
Combinations of bonding methods provided
for in at least two different groups from
\textbf{H01L 2224/82828} - \textbf{H01L 2224/82897}

involving monitoring, e.g. feedback loop

- \textbf{H01L 2224/82809} \\
Post-treatment of the connector or the bonding area

Cleaning, e.g. oxide removal step,
desmearing

- \textbf{H01L 2224/82891} \\
Reshaping

by chemical means, e.g. etching,
anodisation

- \textbf{H01L 2224/82831} \\
by chemical means, e.g. etching,
anodisation

using a laser

using a corona discharge, e.g. electronic
flame off [EFO]

by mechanical means, e.g. severing,
pressing, stamping

Thermal treatments, e.g. annealing,
controlled pre-heating or pre-cooling

Forming additional members

Specific sequence of steps, e.g. repetition of
manufacturing steps, time sequence

using a layer connector

involving a temporary auxiliary member not
forming part of the bonding apparatus

involving a permanent auxiliary member being
left in the finished device, e.g. aids for holding
or protecting the layer connector during or after
the bonding process

Pre-treatment of the layer connector or the
bonding area

Cleaning the layer connector, e.g. oxide
removal step, desmearing

Chemical cleaning, e.g. etching, flux

Mechanical cleaning, e.g. abrasion
using hydro blasting, brushes, ultrasonic
cleaning, dry ice blasting, gas-flow

Plasma cleaning

Thermal cleaning, e.g. decomposition, sublimation

Combinations of two or more
cleaning methods provided for in
at least two different groups from
\textbf{H01L 2224/83001} - \textbf{H01L 2224/83014}

Applying permanent coating to the layer
connector in the bonding apparatus, e.g. in-situ
coating

Cleaning the bonding area, e.g. oxide
removal step, desmearing

Applying flux to the bonding area

Applying a precursor material to the bonding
area

Reshaping the layer connector in the bonding
apparatus, e.g. flattening the layer connector

by chemical means, e.g. etching,
anodisation

by heating means

using a polychromatic heating lamp

using a laser

Induction heating, i.e. eddy currents

by mechanical means, e.g. severing,
pressing, stamping

Thermal treatments, e.g. annealing,
controlled pre-heating or pre-cooling

Forming additional members, e.g. dam
structures

Detaching layer connectors, e.g. after testing
(unsoldering in general \textbf{B23K 1/018})

Bonding environment

Composition of the atmosphere

being oxidating

being reducing

being inert

being a liquid, e.g. for fluidic self-assembly

Vacuum

Under pressure

Atmospheric pressure

Transient conditions, e.g. gas-flow
mounting
Arrangement of the layer connectors prior to connecting process

Lateral distribution of the layer connectors

Compressing, e.g. by applying pressure, e.g. by injection

Aligning
Active alignment, i.e. by apparatus steering, e.g. optical alignment using marks or sensors

by detecting inherent features of, or outside, the semiconductor or solid-state body

the layer connector being supplied to the parts to be connected in the bonding apparatus

as prepreg comprising a layer connector, e.g. provided in an insulating plate member

using surface energy, e.g. capillary forces

by applying pressure, e.g. by injection

involving protection against electrical discharge, e.g. removing electrostatic charge

Material (material of the layer connector), bond-through coating

bond-through coating having an external coating, e.g. protective coating

Shape, e.g. interlocking features

and subgroups)

Regulatory
Thermocompression bonding, e.g. thermocompression welding or solid-state welding

Thermosonic bonding

Direction of oscillation

Thermosonic bonding

applying unidirectional static pressure

applying isostatic pressure, e.g. degassing using vacuum or a pressurised liquid

using a reflow oven

with a graded temperature profile

using an electron beam (electron beam welding in general B23K 15/00)

using electric resistance welding, i.e. ohmic heating

Bonding interfaces of the layer connector

Shape, e.g. interlocking features

having an external coating, e.g. protective bond-through coating

Material (material of the layer connector prior to the connecting process H01L 2224/29099 and H01L 2224/29599, and subgroups)

Bonding interfaces outside the semiconductor or solid-state body

Shape, e.g. interlocking features

having an exterior coating, e.g. protective bond-through coating

Material

with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

the principal constituent melting at a temperature of less than 400°C

Gallium [Ga] as principal constituent

Indium [In] as principal constituent

Tin [Sn] as principal constituent

Bismuth [Bi] as principal constituent

Thallium [Tl] as principal constituent

Lead [Pb] as principal constituent
2224/83417 . . . . the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
2224/83418 . . . . Zinc [Zn] as principal constituent
2224/8342 . . . . Antimony [Sb] as principal constituent
2224/83423 . . . . Magnesium [Mg] as principal constituent
2224/83424 . . . . Aluminium [Al] as principal constituent
2224/83438 . . . . the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
2224/83439 . . . . Silver [Ag] as principal constituent
2224/83444 . . . . Gold [Au] as principal constituent
2224/83447 . . . . Copper [Cu] as principal constituent
2224/83449 . . . . Manganese [Mn] as principal constituent
2224/83455 . . . . Nickel [Ni] as principal constituent
2224/83457 . . . . Cobalt [Co] as principal constituent
2224/8346 . . . . Iron [Fe] as principal constituent
2224/83463 . . . . the principal constituent melting at a temperature of greater than 1550°C
2224/83464 . . . . Palladium [Pd] as principal constituent
2224/83466 . . . . Titanium [Ti] as principal constituent
2224/83469 . . . . Platinum [Pt] as principal constituent
2224/8347 . . . . Zirconium [Zr] as principal constituent
2224/83471 . . . . Chromium [Cr] as principal constituent
2224/83472 . . . . Vanadium [V] as principal constituent
2224/83473 . . . . Rhodium [Rh] as principal constituent
2224/83476 . . . . Ruthenium [Ru] as principal constituent
2224/83478 . . . . Iridium [Ir] as principal constituent
2224/83479 . . . . Niobium [Nb] as principal constituent
2224/8348 . . . . Molybdenum [Mo] as principal constituent
2224/83481 . . . . Tantalum [Ta] as principal constituent
2224/83483 . . . . Rhenium [Re] as principal constituent
2224/83484 . . . . Tungsten [W] as principal constituent
2224/83486 . . . . with a principal constituent of the material being a non metallic, non metalloid inorganic material
2224/83487 . . . . Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/8348)
2224/83488 . . . . Glasses, e.g. amorphous oxides, nitrides or fluorides
2224/8349 . . . . with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy
2224/83491 . . . . The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene
2224/83493 . . . . with a principal constituent of the material being a solid not provided for in groups H01L 2224/834 - H01L 2224/83491, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
2224/83494 . . . . with a principal constituent of the material being a liquid not provided for in groups H01L 2224/834 - H01L 2224/83491

2224/83495 . . . . with a principal constituent of the material being a gas not provided for in groups H01L 2224/834 - H01L 2224/83491
2224/83498 . . . . with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams
2224/83499 . . . . Material of the matrix
2224/835 . . . . with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof
2224/83501 . . . . the principal constituent melting at a temperature of less than 400°C
2224/83505 . . . . Gallium [Ga] as principal constituent
2224/83509 . . . . Indium [In] as principal constituent
2224/83511 . . . . Tin [Sn] as principal constituent
2224/83513 . . . . Bismuth [Bi] as principal constituent
2224/83514 . . . . Thallium [Tl] as principal constituent
2224/83516 . . . . Lead [Pb] as principal constituent
2224/83517 . . . . the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
2224/83518 . . . . Zinc [Zn] as principal constituent
2224/8352 . . . . Antimony [Sb] as principal constituent
2224/83523 . . . . Magnesium [Mg] as principal constituent
2224/83524 . . . . Aluminium [Al] as principal constituent
2224/83538 . . . . the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
2224/83539 . . . . Silver [Ag] as principal constituent
2224/83544 . . . . Gold [Au] as principal constituent
2224/83547 . . . . Copper [Cu] as principal constituent
2224/83549 . . . . Manganese [Mn] as principal constituent
2224/83555 . . . . Nickel [Ni] as principal constituent
2224/83557 . . . . Cobalt [Co] as principal constituent
2224/8356 . . . . Iron [Fe] as principal constituent
2224/83563 . . . . the principal constituent melting at a temperature of greater than 1550°C
2224/83564 . . . . Palladium [Pd] as principal constituent
2224/83566 . . . . Titanium [Ti] as principal constituent
2224/83569 . . . . Platinum [Pt] as principal constituent
<table>
<thead>
<tr>
<th>Code</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>2224/8357</td>
<td>Zirconium [Zr] as principal constituent</td>
</tr>
<tr>
<td>2224/83571</td>
<td>Chromium [Cr] as principal constituent</td>
</tr>
<tr>
<td>2224/83572</td>
<td>Vanadium [V] as principal constituent</td>
</tr>
<tr>
<td>2224/83573</td>
<td>Rhodium [Rh] as principal constituent</td>
</tr>
<tr>
<td>2224/83576</td>
<td>Ruthenium [Ru] as principal constituent</td>
</tr>
<tr>
<td>2224/83578</td>
<td>Iridium [Ir] as principal constituent</td>
</tr>
<tr>
<td>2224/83579</td>
<td>Niobium [Nb] as principal constituent</td>
</tr>
<tr>
<td>2224/8358</td>
<td>Molybdenum [Mo] as principal constituent</td>
</tr>
<tr>
<td>2224/83581</td>
<td>Tantalum [Ta] as principal constituent</td>
</tr>
<tr>
<td>2224/83583</td>
<td>Rhenium [Re] as principal constituent</td>
</tr>
<tr>
<td>2224/83584</td>
<td>Tungsten [W] as principal constituent</td>
</tr>
<tr>
<td>2224/83586</td>
<td>with a principal constituent of the material being a non metallic, non metalloid inorganic material</td>
</tr>
<tr>
<td>2224/83587</td>
<td>Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/83588)</td>
</tr>
<tr>
<td>2224/83588</td>
<td>Glasses, e.g. amorphous oxides, nitrides or fluorides</td>
</tr>
<tr>
<td>2224/8359</td>
<td>with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy</td>
</tr>
<tr>
<td>2224/83591</td>
<td>The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene</td>
</tr>
<tr>
<td>2224/83593</td>
<td>with a principal constituent of the material being a solid not provided for in groups H01L 2224/835 - H01L 2224/83591, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond</td>
</tr>
<tr>
<td>2224/83594</td>
<td>with a principal constituent of the material being a liquid not provided for in groups H01L 2224/835 - H01L 2224/83591</td>
</tr>
<tr>
<td>2224/83595</td>
<td>with a principal constituent of the material being a gas not provided for in groups H01L 2224/835 - H01L 2224/83591</td>
</tr>
<tr>
<td>2224/83598</td>
<td>Fillers</td>
</tr>
<tr>
<td>2224/83599</td>
<td>Base material</td>
</tr>
<tr>
<td>2224/836</td>
<td>with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof</td>
</tr>
<tr>
<td>2224/83601</td>
<td>the principal constituent melting at a temperature of less than 400°C</td>
</tr>
<tr>
<td>2224/83605</td>
<td>Gallium [Ga] as principal constituent</td>
</tr>
<tr>
<td>2224/83609</td>
<td>Indium [In] as principal constituent</td>
</tr>
<tr>
<td>2224/83611</td>
<td>Tin [Sn] as principal constituent</td>
</tr>
<tr>
<td>2224/83613</td>
<td>Bismuth [Bi] as principal constituent</td>
</tr>
<tr>
<td>2224/83614</td>
<td>Thallium [Tl] as principal constituent</td>
</tr>
<tr>
<td>2224/83616</td>
<td>Lead [Pb] as principal constituent</td>
</tr>
<tr>
<td>2224/83617</td>
<td>the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C</td>
</tr>
<tr>
<td>2224/83618</td>
<td>Zinc [Zn] as principal constituent</td>
</tr>
<tr>
<td>2224/8362</td>
<td>Antimony [Sb] as principal constituent</td>
</tr>
<tr>
<td>2224/83623</td>
<td>Magnesium [Mg] as principal constituent</td>
</tr>
<tr>
<td>2224/83624</td>
<td>Aluminium [Al] as principal constituent</td>
</tr>
<tr>
<td>2224/83638</td>
<td>the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C</td>
</tr>
<tr>
<td>2224/83639</td>
<td>Silver [Ag] as principal constituent</td>
</tr>
<tr>
<td>2224/83644</td>
<td>Gold [Au] as principal constituent</td>
</tr>
<tr>
<td>2224/83647</td>
<td>Copper [Cu] as principal constituent</td>
</tr>
<tr>
<td>2224/83649</td>
<td>Manganese [Mn] as principal constituent</td>
</tr>
<tr>
<td>2224/83655</td>
<td>Nickel [Ni] as principal constituent</td>
</tr>
<tr>
<td>2224/83657</td>
<td>Cobalt [Co] as principal constituent</td>
</tr>
<tr>
<td>2224/8366</td>
<td>Iron [Fe] as principal constituent</td>
</tr>
<tr>
<td>2224/83663</td>
<td>the principal constituent melting at a temperature of greater than 1550°C</td>
</tr>
<tr>
<td>2224/83664</td>
<td>Palladium [Pd] as principal constituent</td>
</tr>
<tr>
<td>2224/83666</td>
<td>Titanium [Ti] as principal constituent</td>
</tr>
<tr>
<td>2224/83669</td>
<td>Platinum [Pt] as principal constituent</td>
</tr>
<tr>
<td>2224/8367</td>
<td>Zirconium [Zr] as principal constituent</td>
</tr>
<tr>
<td>2224/83671</td>
<td>Chromium [Cr] as principal constituent</td>
</tr>
<tr>
<td>2224/83672</td>
<td>Vanadium [V] as principal constituent</td>
</tr>
<tr>
<td>2224/83673</td>
<td>Rhodium [Rh] as principal constituent</td>
</tr>
<tr>
<td>2224/83676</td>
<td>Ruthenium [Ru] as principal constituent</td>
</tr>
<tr>
<td>2224/83678</td>
<td>Iridium [Ir] as principal constituent</td>
</tr>
<tr>
<td>2224/83679</td>
<td>Niobium [Nb] as principal constituent</td>
</tr>
</tbody>
</table>
polonium [Po], and alloys thereof
antimony [Sb], tellurium [Te] and [Si], germanium [Ge], arsenic [As], metalloid, e.g. boron [B], silicon
metalloid inorganic material with a principal constituent of the material being a non metallic, non metalloid inorganic material
Ceramics, e.g. crystalline carbides, nitrates or oxides (glass ceramics H01L 2224/83688)
Glassess, e.g. amorphous oxides, nitrates or fluorides
with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy
The principal constituent being an elastomer, e.g. silicons, isoprene, neoprene
with a principal constituent of the material being a solid not provided for in groups H01L 2224/836 - H01L 2224/83691, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
with a principal constituent of the material being a liquid not provided for in groups H01L 2224/836 - H01L 2224/83691
with a principal constituent of the material being a gas not provided for in groups H01L 2224/836 - H01L 2224/83691
with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams
Coating material
with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof
the principal constituent melting at a temperature of less than 400°C
Gallium [Ga] as principal constituent
Indium [In] as principal constituent
Tin [Sn] as principal constituent
Bismuth [Bi] as principal constituent
Thallium [Tl] as principal constituent
Lead [Pb] as principal constituent
the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
Nickel [Ni] as principal constituent
Cobalt [Co] as principal constituent
Iron [Fe] as principal constituent
the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
Silver [Ag] as principal constituent
Gold [Au] as principal constituent
Copper [Cu] as principal constituent
Manganese [Mn] as principal constituent
Nickel [Ni] as principal constituent
Cobalt [Co] as principal constituent
Iron [Fe] as principal constituent
the principal constituent melting at a temperature of greater than 1550°C
Palladium [Pd] as principal constituent
Titanium [Ti] as principal constituent
Platinum [Pt] as principal constituent
Zirconium [Zr] as principal constituent
Chromium [Cr] as principal constituent
Vanadium [V] as principal constituent
Rhodium [Rh] as principal constituent
Ruthenium [Ru] as principal constituent
Iridium [Ir] as principal constituent
Niobium [Nb] as principal constituent
Molybdenum [Mo] as principal constituent
Tantalum [Ta] as principal constituent
Rhenium [Re] as principal constituent
Tungsten [W] as principal constituent
Bonding techniques
- Polyester
- Epoxy
- Polyimide
- Using a polymer adhesive, e.g. an adhesive

Sintering
- Soldering or alloying

Hardening the adhesive by curing, i.e.
- Moisture curing, i.e. curing by exposing
to humidity, e.g. for silicones and polyurethanes
- Hardening the adhesive by cooling, e.g. for thermoplastics or hot-melt adhesives
- Combinations of two or more hardening methods provided for in at least two different groups from
- 83855 - 83838
  - e.g. for hybrid thermoplastic-thermosetting adhesives

Involving a self-assembly process, e.g. self-agglomeration of a material dispersed in a fluid
- Auxiliary means therefor, e.g. for self-assembly activation
- With special adaptation of the surface of the body to be connected, e.g. surface shape specially adapted for the self-assembly process

Involving the material of the bonding area, e.g. bonding pad
- Using an inorganic non metallic glass type adhesive, e.g. solder glass
- Anodic bonding, i.e. bonding by applying a voltage across the interface in order to induce ions migration leading to an irreversible chemical bond
- Direct bonding, i.e. joining surfaces by means of intermolecular attracting interactions at their interfaces, e.g. covalent bonds, van der Waals forces

Between electrically conductive surfaces, e.g. copper-copper direct bonding, surface activated bonding
- Between electrically insulating surfaces, e.g. oxide or nitride layers
- Mechanical interlocking, e.g. anchoring, hook and loop-type fastening or the like
- Press-fitting, i.e. pushing the parts together and fastening by friction, e.g. by compression of one part against the other

Using resilient parts in the layer connector or in the bonding area
- With the layer connector not providing any mechanical bonding
- Pressing the layer connector against the bonding areas by means of another connector
- By means of another layer connector
- By means of a bump connector
- By means of an encapsulation layer or foil
- Combinations of bonding methods provided for in at least two different groups from

Specific sequence of method steps
- Intermediate bonding, i.e. intermediate bonding step for temporaroly bonding the semiconductor or solid-state body, followed by at least a further bonding step
- Involving monitoring, e.g. feedback loop
- Post-treatment of the layer connector or bonding area
- Cleaning, e.g. oxide removal step, desmearing
Chemical cleaning, e.g. etching, flux
Mechanical cleaning, e.g. abrasion using hydro blasting, brushes, ultrasonic cleaning, dry ice blasting, gas-flow
Plasma cleaning
Thermal cleaning, e.g. using laser ablation or by electrostatic corona discharge
Combinations of two or more cleaning methods provided for in at least two different groups from H01L 2224/8401 - H01L 2224/84014
Applying permanent coating, e.g. protective coating
Reshaping
by chemical means, e.g. etching
by heating means, e.g. reflowing
using a polychromatic heating lamp
using a laser
Induction heating, i.e. eddy currents
using a flame torch, e.g. hydrogen torch
using a corona discharge, e.g. electronic flame off [EFO]
by mechanical means, e.g. "pull-and-cut", pressing, stamping
Thermal treatments, e.g. annealing, controlled cooling
Forming additional members, e.g. for reinforcing, fillet sealant
Specific sequence of steps, e.g. repetition of manufacturing steps, time sequence
using a strap connector
involving a temporary auxiliary member not forming part of the bonding apparatus
being a removable or sacrificial coating
being a temporary substrate
involving a permanent auxiliary member being left in the finished device, e.g. aids for holding or protecting the strap connector during or after the bonding process
Pre-treatment of the connector and/or the bonding area
Cleaning, e.g. oxide removal step, desmearing
Chemical cleaning, e.g. etching, flux
Mechanical cleaning, e.g. abrasion using hydro blasting, brushes, ultrasonic cleaning, dry ice blasting, gas-flow
Plasma cleaning
Thermal cleaning, e.g. decomposition, sublimation
Combinations of two or more cleaning methods provided for in at least two different groups from H01L 2224/8401 - H01L 2224/84014
Applying permanent coating, e.g. in-situ coating
Reshaping
by chemical means, e.g. etching, anodisation
by heating means, e.g. "free-air-ball"
using a polychromatic heating lamp
using a laser
Induction heating, i.e. eddy currents
using a flame torch, e.g. hydrogen torch
using a corona discharge, e.g. electronic flame off [EFO]
by mechanical means, e.g. severing, pressing, stamping
Thermal treatments, e.g. annealing, controlled pre-heating or pre-cooling
Forming additional members
Bonding environment
Composition of the atmosphere
being oxidating
being reducing
being inert
being a liquid (e.g. for fluidic self-assembly)
Vacuum
Under pressure
Atmospheric pressure
Transient conditions, e.g. gas-flow
Temperature settings
Transient conditions
Heating
Cooling
Ambient temperature
the connector being supplied to the parts to be connected in the bonding apparatus
involving protection against electrical discharge, e.g. removing electrostatic charge
Aligning
Active alignment, i.e. by apparatus steering, e.g. optical alignment using marks or sensors
by detecting inherent features of, or outside, the semiconductor or solid-state body
Shape or position of the body
Bonding areas on the body
Bonding areas outside the body
Shape or position of the other item
using marks formed on the semiconductor or solid-state body
using marks formed outside the semiconductor or solid-state body, i.e. "off-chip"
involving guiding structures, e.g. spacers or supporting members
the guiding structures being at least partially left in the finished device
Passive alignment, i.e. self alignment, e.g. using surface energy, chemical reactions, thermal equilibrium
involving movement of a part of the bonding apparatus
being the lower part of the bonding apparatus, i.e. holding means for the bodies to be connected, e.g. XY table
Rotational movements
Translational movements
being the upper part of the bonding apparatus, i.e. bonding head,
Rotational movements
Translational movements
connecting first on the semiconductor or solid-state body, i.e. on-chip, regular stitch
... connecting first outside the semiconductor or solid-state body, i.e. off-chip, reverse stitch

... connecting first both on and outside the semiconductor or solid-state body, i.e. regular and reverse stitches

... involving intermediate connecting steps before cutting the strap connector

... Applying energy for connecting

... Compression bonding

... Thermocompression bonding

... Ultrasonic bonding

... Direction of oscillation

... Thermosonic bonding

... with energy being in the form of electromagnetic radiation

... Induction heating, i.e. eddy currents

... using a laser

... Polychromatic or infrared lamp heating

... using an autocatalytic reaction, e.g. exothermic brazing

... using means for applying energy being within the device, e.g. integrated heater

... using electro-static corona discharge

... using an electron beam (electron beam welding in general B23K 15/00)

... using electric resistance welding, i.e. ohmic heating

... Bonding interfaces of the connector

... Shape, e.g. interlocking features

... having an external coating, e.g. protective bond-through coating

... Material

... Bonding interfaces of the semiconductor or solid state body

... Shape, e.g. interlocking features

... having an external coating, e.g. protective bond-through coating

... Material

... Bonding interfaces outside the semiconductor or solid-state body

... Shape, e.g. interlocking features

... having an external coating, e.g. protective bond-through coating

... Material

... with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

... the principal constituent melting at a temperature of less than 400°C

... Gallium [Ga] as principal constituent

... Indium [In] as principal constituent

... Tin [Sn] as principal constituent

... Bismuth [Bi] as principal constituent

... Thallium [Tl] as principal constituent

... Lead [Pb] as principal constituent

... the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

... Zinc [Zn] as principal constituent

... Antimony [Sb] as principal constituent

... Magnesium [Mg] as principal constituent

... Aluminium [Al] as principal constituent

... the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

... Silver [Ag] as principal constituent

... Gold [Au] as principal constituent

... Copper [Cu] as principal constituent

... Manganese [Mn] as principal constituent

... Palladium [Pd] as principal constituent

... Titanium [Ti] as principal constituent

... Platinum [Pt] as principal constituent

... Zirconium [Zr] as principal constituent

... Chromium [Cr] as principal constituent

... Vanadium [V] as principal constituent

... Rhodium [Rh] as principal constituent

... Ruthenium [Ru] as principal constituent

... Iridium [Ir] as principal constituent

... Niobium [Nb] as principal constituent

... Molybdenum [Mo] as principal constituent

... Tantalum [Ta] as principal constituent

... Rhenium [Re] as principal constituent

... Tungsten [W] as principal constituent

... with a principal constituent of the material being a non metallic, non metalloid inorganic material

... Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/84488)

... Glasses, e.g. amorphous oxides, nitrides or fluorides

... with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

... The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

... with a principal constituent of the material being a solid not provided for in groups H01L 2224/84493 - H01L 2224/84491, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

... with a principal constituent of the material being a liquid not provided for in groups H01L 2224/84493 - H01L 2224/84491

... with a principal constituent of the material being a gas not provided for in groups H01L 2224/84493 - H01L 2224/84491
<table>
<thead>
<tr>
<th>CPC - 2019.08</th>
</tr>
</thead>
<tbody>
<tr>
<td>2224/84498</td>
</tr>
<tr>
<td>2224/84499</td>
</tr>
<tr>
<td>2224/845</td>
</tr>
<tr>
<td>2224/84501</td>
</tr>
<tr>
<td>2224/84505</td>
</tr>
<tr>
<td>2224/84509</td>
</tr>
<tr>
<td>2224/84511</td>
</tr>
<tr>
<td>2224/84513</td>
</tr>
<tr>
<td>2224/84514</td>
</tr>
<tr>
<td>2224/84516</td>
</tr>
<tr>
<td>2224/84517</td>
</tr>
<tr>
<td>2224/84518</td>
</tr>
<tr>
<td>2224/8452</td>
</tr>
<tr>
<td>2224/84523</td>
</tr>
<tr>
<td>2224/84524</td>
</tr>
<tr>
<td>2224/84538</td>
</tr>
<tr>
<td>2224/84539</td>
</tr>
<tr>
<td>2224/84544</td>
</tr>
<tr>
<td>2224/84547</td>
</tr>
<tr>
<td>2224/84549</td>
</tr>
<tr>
<td>2224/84555</td>
</tr>
<tr>
<td>2224/84557</td>
</tr>
<tr>
<td>2224/8456</td>
</tr>
<tr>
<td>2224/84563</td>
</tr>
<tr>
<td>2224/84564</td>
</tr>
<tr>
<td>2224/84566</td>
</tr>
<tr>
<td>2224/84569</td>
</tr>
<tr>
<td>2224/8457</td>
</tr>
<tr>
<td>2224/84571</td>
</tr>
<tr>
<td>2224/84572</td>
</tr>
<tr>
<td>2224/84573</td>
</tr>
<tr>
<td>2224/84576</td>
</tr>
<tr>
<td>2224/84578</td>
</tr>
<tr>
<td>2224/84579</td>
</tr>
<tr>
<td>2224/8458</td>
</tr>
<tr>
<td>2224/84581</td>
</tr>
<tr>
<td>2224/84583</td>
</tr>
<tr>
<td>2224/84584</td>
</tr>
<tr>
<td>2224/84586</td>
</tr>
<tr>
<td>2224/84587</td>
</tr>
<tr>
<td>2224/84588</td>
</tr>
<tr>
<td>2224/8459</td>
</tr>
<tr>
<td>2224/84591</td>
</tr>
<tr>
<td>2224/84593</td>
</tr>
<tr>
<td>2224/84594</td>
</tr>
<tr>
<td>2224/84595</td>
</tr>
<tr>
<td>2224/84598</td>
</tr>
<tr>
<td>2224/84599</td>
</tr>
<tr>
<td>2224/846</td>
</tr>
<tr>
<td>2224/84601</td>
</tr>
<tr>
<td>2224/84605</td>
</tr>
<tr>
<td>2224/84609</td>
</tr>
<tr>
<td>2224/84611</td>
</tr>
</tbody>
</table>
Bismuth [Bi] as principal constituent
Thallium [Tl] as principal constituent
Lead [Pb] as principal constituent
the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
Zinc [Zn] as principal constituent
Antimony [Sb] as principal constituent
Magnesium [Mg] as principal constituent
Aluminium [Al] as principal constituent
the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
Silver [Ag] as principal constituent
Gold [Au] as principal constituent
Copper [Cu] as principal constituent
Manganese [Mn] as principal constituent
Nickel [Ni] as principal constituent
Cobalt [Co] as principal constituent
Iron [Fe] as principal constituent
the principal constituent melting at a temperature of greater than 1550°C
Palladium [Pd] as principal constituent
Titanium [Ti] as principal constituent
Platinum [Pt] as principal constituent
Zirconium [Zr] as principal constituent
Chromium [Cr] as principal constituent
Vanadium [V] as principal constituent
Rhodium [Rh] as principal constituent
Ruthenium [Ru] as principal constituent
Iridium [Ir] as principal constituent
Niobium [Nb] as principal constituent
Molybdenum [Mo] as principal constituent
Tantalum [Ta] as principal constituent
Rhenium [Re] as principal constituent
Tungsten [W] as principal constituent
with a principal constituent of the material being a non metallic, non metalloid inorganic material
Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/84688)
Glasses, e.g. amorphous oxides, nitrides or fluorides
with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy
The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene
with a principal constituent of the material being a solid not provided for in groups H01L 2224/846 - H01L 2224/84691, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
with a principal constituent of the material being a liquid not provided for in groups H01L 2224/846 - H01L 2224/84691
with a principal constituent of the material being a gas not provided for in groups H01L 2224/846 - H01L 2224/84691
with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams
Coating material
with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof
Glasses, e.g. amorphous oxides, nitrides or fluorides
The principal constituent melting at a temperature of greater than 400°C
Gallium [Ga] as principal constituent
Indium [In] as principal constituent
Tin [Sn] as principal constituent
Bismuth [Bi] as principal constituent
Thallium [Tl] as principal constituent
Lead [Pb] as principal constituent
2224/84717 . . . . . . the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
2224/84718 . . . . . . Zinc [Zn] as principal constituent
2224/84719 . . . . . . Antimony [Sb] as principal constituent
2224/84720 . . . . . . Magnesium [Mg] as principal constituent
2224/84721 . . . . . . Aluminium [Al] as principal constituent
2224/84722 . . . . . . the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
2224/84723 . . . . . . Silver [Ag] as principal constituent
2224/84724 . . . . . . Gold [Au] as principal constituent
2224/84725 . . . . . . Copper [Cu] as principal constituent
2224/84726 . . . . . . the principal constituent melting at a temperature of greater than 1550°C
2224/84727 . . . . . . Palladium [Pd] as principal constituent
2224/84728 . . . . . . Titanium [Ti] as principal constituent
2224/84729 . . . . . . Platinum [Pt] as principal constituent
2224/84730 . . . . . . Zirconium [Zr] as principal constituent
2224/84731 . . . . . . Chromium [Cr] as principal constituent
2224/84732 . . . . . . Vanadium [V] as principal constituent
2224/84733 . . . . . . Rhodium [Rh] as principal constituent
2224/84734 . . . . . . Ruthenium [Ru] as principal constituent
2224/84735 . . . . . . Iridium [Ir] as principal constituent
2224/84736 . . . . . . Niobium [Nb] as principal constituent
2224/84737 . . . . . . Molybdenum [Mo] as principal constituent
2224/84738 . . . . . . Tantalum [Ta] as principal constituent
2224/84739 . . . . . . Rhenium [Re] as principal constituent
2224/84740 . . . . . . Tungsten [W] as principal constituent
2224/84741 . . . . . . with a principal constituent of the material being a non metallic, non metalloid inorganic material
2224/84742 . . . . . . Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics
2224/84743 . . . . . . Glasses, e.g. amorphous oxides, nitrides or fluorides
2224/84744 . . . . . . with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy
2224/84745 . . . . . . The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene
2224/84746 . . . . . . with a principal constituent of the material being a solid not provided for in groups
2224/84747 . . . . . . e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
2224/84748 . . . . . . with a principal constituent of the material being a liquid not provided for in groups
2224/84749 . . . . . . e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
2224/84750 . . . . . . with a principal constituent of the material being a gas not provided for in groups
2224/84751 . . . . . . with a principal constituent of the material being a gas not provided for in groups
2224/84752 . . . . . . with a principal constituent of the material being a solid not provided for in groups
2224/84753 . . . . . . with a principal constituent of the material being a solid not provided for in groups
2224/84754 . . . . . . with a principal constituent of the material being a solid not provided for in groups
2224/84755 . . . . . . with a principal constituent of the material being a solid not provided for in groups
2224/84756 . . . . . . with a principal constituent of the material being a solid not provided for in groups
2224/84757 . . . . . . with a principal constituent of the material being a solid not provided for in groups
2224/84758 . . . . . . with a principal constituent of the material being a solid not provided for in groups
2224/84759 . . . . . . with a principal constituent of the material being a solid not provided for in groups
2224/84760 . . . . . . with a principal constituent of the material being a solid not provided for in groups
2224/84761 . . . . . . with a principal constituent of the material being a solid not provided for in groups
2224/84762 . . . . . . with a principal constituent of the material being a solid not provided for in groups
2224/84763 . . . . . . with a principal constituent of the material being a solid not provided for in groups

2224/84764 . . . . . . Bonding techniques
2224/84765 . . . . . . Soldering or alloying
2224/84766 . . . . . . involving forming a eutectic alloy at the bonding interface
2224/84767 . . . . . . involving forming an intermetallic compound at the bonding interface
2224/84768 . . . . . . Reflow soldering
2224/84769 . . . . . . Diffusion bonding
2224/84770 . . . . . . Solid-liquid interdiffusion
2224/84771 . . . . . . Solid-solid interdiffusion
2224/84772 . . . . . . Sintering
2224/84773 . . . . . . using a polymer adhesive, e.g. an adhesive based on silicone, epoxy, polyimide, polyester
2224/84774 . . . . . . Hardening the adhesive by curing, i.e. thermosetting
2224/84775 . . . . . . Pre-cured adhesive, i.e. B-stage adhesive
2224/84776 . . . . . . Localised curing of parts of the connector
2224/84777 . . . . . . Heat curing
2224/84778 . . . . . . Microwave curing
2224/84779 . . . . . . Infrared [IR] curing
2224/84780 . . . . . . Visible light curing
2224/84781 . . . . . . Ultraviolet [UV] curing
2224/84782 . . . . . . Moisture curing, i.e. curing by exposing to humidity, e.g. for silicones and polyurethanes
2224/84783 . . . . . . Hardening the adhesive by cooling, e.g. for thermoplastics or hot-melt adhesives
using a wire connector

substrate
e.g. removable or sacrificial coating, film or not forming part of the bonding apparatus,

specific sequence of steps, e.g. repetition of

involving monitoring, e.g. feedback loop

post-treatment of the connector or bonding area

cleaning, e.g. oxide removal step, desmearing

chemical cleaning, e.g. etching, flux

mechanical cleaning, e.g. abrasion

thermal cleaning, e.g. decomposition, sublimation

plasma cleaning

using a corona discharge, e.g. electronic

using a flame torch, e.g. hydrogen torch

induction heating, i.e. eddy currents

using a flame torch, e.g. hydrogen torch

using a corona discharge, e.g. electronic flame off [EFO]

by mechanical means, e.g. forming the ball or the wedge of the wire connector

by chemical means, e.g. etching, anodisation

by heating means, e.g. "free-air-ball"

using a polychromatic heating lamp

using a laser

induction heating, i.e. eddy currents

using a flame torch, e.g. hydrogen torch

using a corona discharge, e.g. electronic flame off [EFO]

by mechanical means, e.g. pressing, stamping

thermal treatments, e.g. annealing, controlled pre-heating or pre-cooling

forming additional members, e.g. for "wedge-on-ball", "ball-on-wedge", "ball-on-ball" connections

bonding environment

composition of the atmosphere

being oxidating

being reducing

being inert

being a liquid, e.g. for fluidic self-assembly

vacuum

under pressure

atmospheric pressure

transient conditions, e.g. gas-flow

temperature settings

transient conditions

heating

cooling

ambient temperature

the connector being supplied to the parts to be connected in the bonding apparatus

involving protection against electrical discharge, e.g. removing electrostatic charge

aligning
Applying energy for connecting
Compression bonding
Thermocompression bonding
Ultrasonic bonding
Direction of oscillation
Thermosonic bonding
with energy being in the form of electromagnetic radiation
Induction heating, i.e. eddy currents
using a laser
Polychromatic or infrared lamp heating
using an autocatalytic reaction, e.g. exothermic brazing
using means for applying energy being within the device, e.g. integrated heater
using electro-static corona discharge
using electron beam (using electron beam in general B23K 15/00)
using electric resistance welding, i.e. ohmic heating
Bonding interfaces of the connector
Shape, e.g. interlocking features
having an external coating, e.g. protective bond-through coating
Material
Bonding interfaces of the semiconductor or solid state body
Shape, e.g. interlocking features
having an external coating, e.g. protective bond-through coating
Material
Bonding interfaces outside the semiconductor or solid-state body
Shape, e.g. interlocking features
having an external coating, e.g. protective bond-through coating
Material
with a principal constituent of the material being a metal or a metalloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof
the principal constituent melting at a temperature of less than 400°C
Gallium (Ga) as principal constituent
Indium (In) as principal constituent
Tin (Sn) as principal constituent
Bismuth (Bi) as principal constituent
Thallium (Tl) as principal constituent
Lead (Pb) as principal constituent
the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C
Zinc (Zn) as principal constituent
Antimony (Sb) as principal constituent
Magnesium (Mg) as principal constituent
Aluminium (Al) as principal constituent
the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C
Silver (Ag) as principal constituent
Gold (Au) as principal constituent
Copper (Cu) as principal constituent
Manganese (Mn) as principal constituent
Nickel (Ni) as principal constituent
Cobalt (Co) as principal constituent
Iron (Fe) as principal constituent
the principal constituent melting at a temperature of greater than 1550°C
Palladium (Pd) as principal constituent
Titanium (Ti) as principal constituent
Platinum (Pt) as principal constituent
Zirconium (Zr) as principal constituent
Chromium (Cr) as principal constituent
segmented structures, foams being a combination of two or more with a principal constituent of the material H01L 2224/854 - H01L 2224/85491 with a principal constituent of the material being a liquid not provided for in groups - H01L 2224/85491 carbon-nanotubes, diamond allotropes of carbon, fullerene, graphite, H01L 2224/854 being a solid not provided for in groups - H01L 2224/85491 glasses, e.g. amorphous oxides, nitrides or fluorides being a non metallic, non metalloid inorganic material ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/85488) with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy the principal constituent being an elastomer, e.g. silicones, isoprene, neoprene with a principal constituent of the material being a solid not provided for in groups H01L 2224/854 - H01L 2224/85491, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond with a principal constituent of the material being a liquid not provided for in groups H01L 2224/854 - H01L 2224/85491 with a principal constituent of the material being a gas not provided for in groups H01L 2224/854 - H01L 2224/85491 with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams material of the matrix with a principal constituent of the material being a metal or a metalloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof the principal constituent melting at a temperature of less than 400°C gallium (Ga) as principal constituent indium (In) as principal constituent tin (Sn) as principal constituent bismuth (Bi) as principal constituent thallium (Tl) as principal constituent lead (Pb) as principal constituent the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C zinc (Zn) as principal constituent antimony (Sb) as principal constituent magnesium (Mg) as principal constituent aluminium (Al) as principal constituent the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C silver (Ag) as principal constituent gold (Au) as principal constituent copper (Cu) as principal constituent manganese (Mn) as principal constituent nickel (Ni) as principal constituent cobalt (Co) as principal constituent iron (Fe) as principal constituent the principal constituent melting at a temperature of greater than 1550°C palladium (Pd) as principal constituent titanium (Ti) as principal constituent platinum (Pt) as principal constituent zirconium (Zr) as principal constituent chromium (Cr) as principal constituent vanadium (V) as principal constituent rhodium (Rh) as principal constituent ruthenium (Ru) as principal constituent iridium (Ir) as principal constituent nickel (Ni) as principal constituent niobium (Nb) as principal constituent molybdenum (Mo) as principal constituent zinc (Zn) as principal constituent thallium (Tl) as principal constituent bismuth (Bi) as principal constituent tin (Sn) as principal constituent indium (In) as principal constituent silver (Ag) as principal constituent aluminium (Al) as principal constituent magnesium (Mg) as principal constituent antimony (Sb) as principal constituent.
### Fillers

#### Base material

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2224/8559</td>
<td>with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy</td>
</tr>
<tr>
<td>2224/85591</td>
<td>The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene</td>
</tr>
<tr>
<td>2224/85593</td>
<td>with a principal constituent of the material being a solid not provided for in groups H01L 2224/855 - H01L 2224/85591, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond</td>
</tr>
<tr>
<td>2224/85594</td>
<td>with a principal constituent of the material being a liquid not provided for in groups H01L 2224/855 - H01L 2224/85591</td>
</tr>
<tr>
<td>2224/85595</td>
<td>with a principal constituent of the material being a gas not provided for in groups H01L 2224/855 - H01L 2224/85591</td>
</tr>
<tr>
<td>2224/85598</td>
<td>Fillers</td>
</tr>
<tr>
<td>2224/85599</td>
<td>with a principal constituent of the material being a metal or a metalloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof</td>
</tr>
<tr>
<td>2224/856</td>
<td>the principal constituent melting at a temperature of less than 400°C</td>
</tr>
<tr>
<td>2224/85601</td>
<td>Gallium (Ga) as principal constituent</td>
</tr>
<tr>
<td>2224/85605</td>
<td>Indium (In) as principal constituent</td>
</tr>
<tr>
<td>2224/85609</td>
<td>Tin (Sn) as principal constituent</td>
</tr>
<tr>
<td>2224/85611</td>
<td>Bismuth (Bi) as principal constituent</td>
</tr>
<tr>
<td>2224/85613</td>
<td>Thallium (Tl) as principal constituent</td>
</tr>
<tr>
<td>2224/85614</td>
<td>Lead (Pb) as principal constituent</td>
</tr>
<tr>
<td>2224/85616</td>
<td>the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C</td>
</tr>
<tr>
<td>2224/85618</td>
<td>Zinc (Zn) as principal constituent</td>
</tr>
<tr>
<td>2224/8562</td>
<td>Antimony (Sb) as principal constituent</td>
</tr>
<tr>
<td>2224/85623</td>
<td>Magnesium (Mg) as principal constituent</td>
</tr>
<tr>
<td>2224/85624</td>
<td>Aluminium (Al) as principal constituent</td>
</tr>
<tr>
<td>2224/85638</td>
<td>the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C</td>
</tr>
<tr>
<td>2224/85639</td>
<td>Silver (Ag) as principal constituent</td>
</tr>
<tr>
<td>2224/85644</td>
<td>Gold (Au) as principal constituent</td>
</tr>
<tr>
<td>2224/85647</td>
<td>Copper (Cu) as principal constituent</td>
</tr>
<tr>
<td>2224/85649</td>
<td>Manganese (Mn) as principal constituent</td>
</tr>
<tr>
<td>2224/85655</td>
<td>Nickel (Ni) as principal constituent</td>
</tr>
<tr>
<td>2224/85657</td>
<td>Cobalt (Co) as principal constituent</td>
</tr>
<tr>
<td>2224/8566</td>
<td>Iron (Fe) as principal constituent</td>
</tr>
<tr>
<td>2224/85663</td>
<td>the principal constituent melting at a temperature of greater than 1550°C</td>
</tr>
<tr>
<td>2224/85664</td>
<td>Palladium (Pd) as principal constituent</td>
</tr>
<tr>
<td>2224/85666</td>
<td>Titanium (Ti) as principal constituent</td>
</tr>
<tr>
<td>2224/85669</td>
<td>Platinum (Pt) as principal constituent</td>
</tr>
<tr>
<td>2224/8567</td>
<td>Zirconium (Zr) as principal constituent</td>
</tr>
<tr>
<td>2224/85671</td>
<td>Chromium (Cr) as principal constituent</td>
</tr>
<tr>
<td>2224/85672</td>
<td>Vanadium (V) as principal constituent</td>
</tr>
<tr>
<td>2224/85673</td>
<td>Rhodium (Rh) as principal constituent</td>
</tr>
<tr>
<td>2224/85676</td>
<td>Ruthenium (Ru) as principal constituent</td>
</tr>
<tr>
<td>2224/85678</td>
<td>Iridium (Ir) as principal constituent</td>
</tr>
<tr>
<td>2224/85679</td>
<td>Niobium (Nb) as principal constituent</td>
</tr>
<tr>
<td>2224/8568</td>
<td>Molybdenum (Mo) as principal constituent</td>
</tr>
<tr>
<td>2224/85681</td>
<td>Tantalum (Ta) as principal constituent</td>
</tr>
<tr>
<td>2224/85683</td>
<td>Rhenium (Re) as principal constituent</td>
</tr>
<tr>
<td>2224/85684</td>
<td>Tungsten (W) as principal constituent</td>
</tr>
<tr>
<td>2224/85686</td>
<td>with a principal constituent of the material being a non metallic, non metalloid inorganic material</td>
</tr>
<tr>
<td>2224/85687</td>
<td>Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/85688)</td>
</tr>
<tr>
<td>2224/85688</td>
<td>Glasses, e.g. amorphous oxides, nitrides or fluorides</td>
</tr>
<tr>
<td>2224/8569</td>
<td>with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy</td>
</tr>
<tr>
<td>2224/85691</td>
<td>The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene</td>
</tr>
<tr>
<td>2224/85693</td>
<td>with a principal constituent of the material being a solid not provided for in groups H01L 2224/856 - H01L 2224/85691, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond</td>
</tr>
</tbody>
</table>
Coating material

with a principal constituent of the material being a liquid
not provided for in groups H01L 2224/856 - H01L 2224/85691

with a principal constituent of the material being a gas
not provided for in groups H01L 2224/856 - H01L 2224/85691

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

with a principal constituent of the material being a metallic or a metallloid, e.g. boron (B), silicon (Si), germanium (Ge), arsenic (As), antimony (Sb), tellurium (Te) and polonium (Po), and alloys thereof

the principal constituent melting at a temperature of less than 400°C

Gallium (Ga) as principal constituent

Indium (In) as principal constituent

Tin (Sn) as principal constituent

Bismuth (Bi) as principal constituent

Thallium (Tl) as principal constituent

Lead (Pb) as principal constituent

the principal constituent melting at a temperature of greater than or equal to 400°C and less than 950°C

Zinc (Zn) as principal constituent

Antimony (Sb) as principal constituent

Magnesium (Mg) as principal constituent

Aluminium (Al) as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950°C and less than 1550°C

Silver (Ag) as principal constituent

Gold (Au) as principal constituent

Copper (Cu) as principal constituent

Manganese (Mn) as principal constituent

Nickel (Ni) as principal constituent

Cobalt (Co) as principal constituent

Iron (Fe) as principal constituent

the principal constituent melting at a temperature of greater than 1550°C

Palladium (Pd) as principal constituent

Titanium (Ti) as principal constituent

Platinum (Pt) as principal constituent

Zirconium (Zr) as principal constituent

Chromium (Cr) as principal constituent

Vanadium (V) as principal constituent

Rhodium (Rh) as principal constituent

Ruthenium (Ru) as principal constituent

Iridium (Ir) as principal constituent

Niobium (Nb) as principal constituent

Molybdenum (Mo) as principal constituent

Tantalum (Ta) as principal constituent

Rhenium (Re) as principal constituent

Tungsten (W) as principal constituent

with a principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/85788)

Glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2224/857 - H01L 2224/85791, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a liquid not provided for in groups H01L 2224/857 - H01L 2224/85791

with a principal constituent of the material being a gas not provided for in groups H01L 2224/857 - H01L 2224/85791
with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

Shape or distribution of the fillers

Bonding techniques

Soldering or alloying

involving forming a eutectic alloy at the bonding interface

involving forming an intermetallic compound at the bonding interface

Reflow soldering

Diffusion bonding

Solid-liquid interdiffusion

Solid-solid interdiffusion, e.g. "direct bonding"

Sintering

using a polymer adhesive, e.g. an adhesive based on silicone, epoxy, polyimide, polyester

Hardening the adhesive by curing, i.e. thermosetting

Pre-cured adhesive, i.e. B-stage adhesive

Localised curing of parts of the connector

Heat curing

Microwave curing

Infrared [IR] curing

Visible light curing

Ultraviolet [UV] curing

Moisture curing, i.e. curing by exposing to humidity, e.g. for silicons and polyurethanes

Hardening the adhesive by cooling, e.g. for thermoplastics or hot-melt adhesives

Combinations of two or more hardening methods provided for in at least two different groups from H01L 2224/8585 - H01L 2224/8588, e.g. for hybrid thermoplastic-thermosetting adhesives

using an inorganic non metallic glass type adhesive, e.g. solder glass

Anodic bonding, i.e. bonding by applying a voltage across the interface in order to induce ions migration leading to an irreversible chemical bond

Direct bonding, i.e. joining surfaces by means of intermolecular attracting interactions at their interfaces, e.g. covalent bonds, van der Waals forces

between electrically conductive surfaces, e.g. copper-copper direct bonding, surface activated bonding

between electrically insulating surfaces, e.g. oxide or nitride layers

Combinations of bonding methods provided for in at least two different groups from H01L 2224/8585 - H01L 2224/8588

involving monitoring, e.g. feedback loop

Post-treatment of the connector or wire bonding area

Cleaning, e.g. oxide removal step, desmearing

Chemical cleaning, e.g. etching, flux

Mechanical cleaning, e.g. abrasion using hydro blasting, brushes, ultrasonic cleaning, dry ice blasting, gas-flow

Plasma cleaning

Thermal cleaning, e.g. using laser ablation or by electrostatic corona discharge

using a laser

Electron beam cleaning

Combinations of two or more cleaning methods provided for in at least two different groups from H01L 2224/8591 - H01L 2224/85914

Applying permanent coating, e.g. protective coating

Reshaping, e.g. for severing the wire, modifying the wedge or ball or the loop shape

by chemical means, e.g. etching

by heating means, e.g. reflowing

using a polychromatic heating lamp

using a laser

Induction heating, i.e. eddy currents

using a flame torch, e.g. hydrogen torch

using a corona discharge, e.g. electronic flame off [EFO]

by mechanical means, e.g. "pull-and-cut", pressing, stamping

Thermal treatments, e.g. annealing, controlled cooling

Forming additional members, e.g. for reinforcing

Specific sequence of steps, e.g. repetition of manufacturing steps, time sequence

using tape automated bonding [TAB]

involving a temporary auxiliary member not forming part of the bonding apparatus

being a removable or sacrificial coating

being a temporary or sacrificial substrate

involving a permanent auxiliary member being left in the finished device, e.g. aids for holding or protecting the TAB connector during or after the bonding process

Pre-treatment of the connector or the bonding area

Cleaning, e.g. oxide removal step, desmearing

Reshaping

by chemical means, e.g. etching, anodisation

by heating

using a laser

using a corona discharge, e.g. electronic flame off [EFO]

by mechanical means, e.g. severing, pressing, stamping

Thermal treatment, e.g. annealing, controlled pre-heating or pre-cooling

Forming additional members
Applying energy for connecting
Aligning
discharge, e.g. removing electrostatic charge
involving protection against electrical
connected in the bonding apparatus
the connector being supplied to the parts to be
involving guiding structures, e.g. spacers or
the guiding structures being at least
Passive alignment, i.e. self alignment, e.g.
invoking movement of a part of the bonding
becoming the lower part of the bonding
Rotational movements
Translational movements
being the upper part of the bonding
Rotational movement
Translational movements
connecting first on the semiconductor
connecting first outside the
connecting first both on and outside
Applying energy for connecting
Compression bonding
Thermo-compression bonding
Ultrasonic bonding
Thermosonic bonding
with energy being in the form of
Induction heating, i.e. eddy currents
using a laser
Polychromatic or infrared lamp heating
using an autocatalytic reaction, e.g.
exothermic brazing
using means for applying energy being
within the device, e.g. integrated heater
using electro-static corona discharge
electron beam (electron beam in
general B23K 15/00)
using electric resistance welding, i.e.
ohmic heating
Bonding interfaces of the connector
Shape, e.g. interlocking features
having an external coating, e.g. protective
bond-through coating
Material
Bonding interfaces of the semiconductor or
solid state body
Shape, e.g. interlocking features
having an external coating, e.g. protective
bond-through coating
Material
Bonding interfaces outside the semiconductor
or solid-state body
Shape, e.g. interlocking features
having an external coating, e.g. protective
bond-through coating
Material
Bonding techniques
Soldering or alloying
involving forming a eutectic alloy at the
bonding interface
involving forming an intermetallic
compound at the bonding interface
Reflow soldering
Diffusion bonding
Solid-liquid interdiffusion
Solid-solid interdiffusion
Sintering
using a polymer adhesive, e.g. an adhesive
based on silicone, epoxy, polyimide,
polyester
Hardening the adhesive by curing, i.e.
thermosetting
Pre-cured adhesive, i.e. B-stage
adhesive
Localised curing of parts of the
connector
Heat curing
Microwave curing
Infrared [IR] curing
Visible light curing
Ultraviolet [UV] curing
Moisture curing, i.e. curing by exposing
to humidity, e.g. for silicones and
polyurethanes
Hardening the adhesive by cooling, e.g. for
thermoplastics or hot-melt adhesives
Combinations of two or more hardening
methods provided for in at least
two different groups selected from
H01L 2224/86855 - H01L 2224/8688
adhesives
using an inorganic non metallic glass type
adhesive, e.g. solder glass

2224/86053 . . . Bonding environment
2224/86054 . . . Composition of the atmosphere
2224/86085 . . . being a liquid, e.g. fluidic self-assembly
2224/8609 . . . Vacuum
2224/86091 . . . Under pressure
2224/86095 . . . Temperature settings
2224/86096 . . . Transient conditions
2224/86097 . . . Heating
2224/86098 . . . Cooling
2224/86099 . . . Ambient temperature
2224/861 . . . . the connector being supplied to the parts to be
connected in the bonding apparatus
2224/8611 . . . . involving protection against electrical
discharge, e.g. removing electrostatic charge
2224/8612 . . . . Aligning
2224/86121 . . . . Active alignment, i.e. by apparatus steering,
e.g. optical alignment using marks or sensors
by detecting inherent features of, or
outside, the semiconductor or solid-state
body
2224/8613 . . . . using marks formed on the semiconductor
or solid-state body
2224/86132 . . . . using marks formed outside the
semiconductor or solid-state body, i.e.
“off-chip”
2224/86136 . . . . involving guiding structures, e.g. spacers or
supporting members
2224/86138 . . . . the guiding structures being at least
partially left in the finished device
2224/86143 . . . . Passive alignment, i.e self alignment, e.g.
using surface energy, chemical reactions,
thermal equilibrium
2224/86148 . . . . involving movement of a part of the bonding
apparatus
2224/86149 . . . . being the lower part of the bonding
apparatus, i.e. holding means for the
bodies to be connected, e.g. XY table
2224/8615 . . . . . . Rotational movements
2224/8616 . . . . . . Translational movements
2224/86169 . . . . . . being the upper part of the bonding
apparatus, e.g. nozzle
2224/8617 . . . . . . Rotational movement
2224/8618 . . . . . . Translational movements
2224/86181 . . . . . . connecting first on the semiconductor
or solid-state body, i.e. on-chip,
2224/86186 . . . . . . connecting first outside the
semiconductor or solid-state body, i.e.
off-chip
2224/86191 . . . . . . connecting first both on and outside
the semiconductor or solid-state body
2224/862 . . . . . . Applying energy for connecting
2224/86201 . . . . . . Compression bonding
2224/86203 . . . . . . Thermo-compression bonding
2224/86205 . . . . . . Ultrasonic bonding
2224/86207 . . . . . . Thermosonic bonding
2224/8621 . . . . . . with energy being in the form of
electromagnetic radiation
2224/86212 . . . . . . Induction heating, i.e. eddy currents
2224/86214 . . . . . . using a laser
2224/8623 . . . . . . Polychromatic or infrared lamp heating
2224/86232 . . . . . . using an autocatalytic reaction, e.g.
2224/86893 . . . . . . Anodic bonding, i.e. bonding by applying a voltage across the interface in order to induce ions migration leading to an irreversible chemical bond

2224/86895 . . . . . . Direct bonding, i.e. joining surfaces by means of intermolecular attracting interactions at their interfaces, e.g. covalent bonds, van der Waals forces

2224/86896 . . . . . . between electrically conductive surfaces, e.g. copper-copper direct bonding, surface activated bonding

2224/86897 . . . . . . between electrically insulating surfaces, e.g. oxide or nitride layers

2224/86899 . . . . . . Combinations of bonding methods provided for in at least two different groups from H01L 2224/868 - H01L 2224/86897

2224/869 . . . . . . involving monitoring, e.g. feedback loop

2224/86909 . . . . . . Post-treatment of the connector or the bonding area

2224/8691 . . . . . . Cleaning, e.g. oxide removal step, desmearing

2224/8693 . . . . . . Reshaping

2224/86931 . . . . . . by chemical means, e.g. etching, anodisation

2224/86935 . . . . . . by heating means

2224/86939 . . . . . . using a laser

2224/86945 . . . . . . using a corona discharge, e.g. electronic flame off [EFO]

2224/86947 . . . . . . by mechanical means, e.g. severing, pressing, stamping

2224/86948 . . . . . . Thermal treatments, e.g. annealing, controlled pre-heating or pre-cooling

2224/86951 . . . . . . Forming additional members

2224/86986 . . . . . . Specific sequence of steps, e.g. repetition of manufacturing steps, time sequence

2224/89 . . . . . . using at least one connector not provided for in any of the groups H01L 2224/81 - H01L 2224/86

2224/90 . . . . . . 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

2224/91 . . . . . . Methods for connecting semiconductor or solid state bodies including different methods provided for in two or more of groups H01L 2224/80 - H01L 2224/90

2224/92 . . . . . . Specific sequence of method steps

2224/9201 . . . . . . Forming connectors during the connecting process, e.g. in-situ formation of bumps

2224/9202 . . . . . . Forming additional connectors after the connecting process

2224/9205 . . . . . . Intermediate bonding steps, i.e. partial connection of the semiconductor or solid-state body during the connecting process

2224/921 . . . . . . Connecting a surface with connectors of different types

2224/9211 . . . . . . Parallel connecting processes

2224/9212 . . . . . . Sequential connecting processes

2224/92122 . . . . . . the first connecting process involving a bump connector

2224/92124 . . . . . . the second connecting process involving a build-up interconnect

2224/92125 . . . . . . the second connecting process involving a layer connector

2224/92127 . . . . . . the second connecting process involving a wire connector

2224/92132 . . . . . . the first connecting process involving a build-up interconnect

2224/92133 . . . . . . the second connecting process involving a bump connector

2224/92135 . . . . . . the second connecting process involving a layer connector

2224/92136 . . . . . . the second connecting process involving a strap connector

2224/92137 . . . . . . the second connecting process involving a wire connector

2224/92138 . . . . . . the second connecting process involving a TAB connector

2224/92142 . . . . . . the first connecting process involving a layer connector

2224/92143 . . . . . . the second connecting process involving a bump connector

2224/92144 . . . . . . the second connecting process involving a build-up interconnect

2224/92147 . . . . . . the second connecting process involving a wire connector

2224/92148 . . . . . . the second connecting process involving a TAB connector

2224/92152 . . . . . . the first connecting process involving a strap connector

2224/92153 . . . . . . the second connecting process involving a bump connector

2224/92155 . . . . . . the second connecting process involving a layer connector

2224/92157 . . . . . . the second connecting process involving a wire connector

2224/92158 . . . . . . the second connecting process involving a TAB connector

2224/92160 . . . . . . the first connecting process involving a layer connector

2224/92162 . . . . . . the first connecting process involving a wire connector

2224/92163 . . . . . . the second connecting process involving a bump connector

2224/92164 . . . . . . the second connecting process involving a build-up interconnect

2224/92165 . . . . . . the second connecting process involving a layer connector

2224/92166 . . . . . . the second connecting process involving a strap connector

2224/92168 . . . . . . the second connecting process involving a TAB connector

2224/92170 . . . . . . the first connecting process involving a TAB connector

2224/92172 . . . . . . the first connecting process involving a TAB connector

2224/92173 . . . . . . the second connecting process involving a bump connector

2224/92174 . . . . . . the second connecting process involving a build-up interconnect

2224/92175 . . . . . . the second connecting process involving a layer connector

2224/92176 . . . . . . the second connecting process involving a strap connector

2224/92177 . . . . . . the second connecting process involving a wire connector

2224/922 . . . . . . Connecting different surfaces of the semiconductor or solid-state body with connectors of different types

2224/9221 . . . . . . Parallel connecting processes

2224/9222 . . . . . . Sequential connecting processes
Batch processes

at wafer-level, i.e. with connecting carried out on a wafer comprising a plurality of undiced individual devices

at chip-level, i.e. with connecting carried out on a plurality of singulated devices, i.e. on diced chips

involving a temporary auxiliary member not forming part of the bonding apparatus, e.g. removable or sacrificial coating, film or substrate

Bonding environment

being a liquid, e.g. for fluidic self-assembly

Under pressure

Atmospheric pressure, e.g. dry self-assembly

Transient conditions, e.g. assisted by a gas flow or a liquid flow

Supplying the plurality of semiconductor or solid-state bodies

in a liquid medium

being a colloidal droplet

using a rack or rail

using a roll-to-roll transfer technique

Aligning the plurality of semiconductor or solid-state bodies

Active alignment, i.e. by apparatus steering

by applying vibration

by applying a pressurised fluid flow, e.g. liquid or gas flow

by applying an electromagnetic field

Electrowetting, i.e. by changing the surface energy of a droplet

involving guiding structures, e.g. shape matching, spacers or supporting members

Passive alignment, i.e. self alignment, e.g. using surface energy, chemical reactions, thermal equilibrium

Magnetic alignment, i.e. using permanent magnetic parts in the semiconductor or solid-state body

Electrostatic alignment, i.e. polarity alignment with Coulomb charges

by surface tension

by molecular lock-key, e.g. by DNA

involving movement of a part of the bonding apparatus

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

the devices being connected to a common substrate, e.g. interposer, said common substrate being separable into individual assemblies after connecting

Methods for disconnecting semiconductor or solid-state bodies

Details relating to assemblies covered by the group H01L 25/00 but not provided for in its subgroups

All the devices being of a type provided for in the same subgroup of groups H01L 27/00 - H01L 51/00

the devices being of a type provided for in group H01L 27/00

the devices not having separate containers

the devices being of a type provided for in group H01L 27/00

Stacked arrangements of devices

Wire or wire-like electrical connections between devices

Wire or wire-like electrical connections from device to substrate

Bump or bump-like direct electrical connections between devices, e.g. flip-chip connection, solder bumps

Bump or bump-like direct electrical connections from device to substrate

Bump or bump-like direct electrical connections from substrate to substrate

Electrical connections formed on device or on substrate, e.g. a deposited or grown layer

Special adaptation of electrical connections, e.g. rewiring, engineering changes, pressure contacts, layout

Non-galvanic coupling, e.g. capacitive coupling

Optical coupling

Electromagnetic shielding

Conductive connections through the device, e.g. vertical interconnects, through silicon via [TSV] (manufacturing via connections per se H01L 21/76898)

Design considerations for via connections, e.g. geometry or layout

Conductive via connections through the substrate, container, or encapsulation

Conductive connections on the side of the device

Geometry of the stack, e.g. form of the devices, geometry to facilitate stacking
2225/06558 . . . . . . the devices having passive surfaces facing each other, i.e. in a back-to-back arrangement
2225/06562 . . . . . . at least one device in the stack being rotated or offset
2225/06565 . . . . . . the devices having the same size and there being no auxiliary carrier between the devices
2225/06568 . . . . . . the devices decreasing in size, e.g. pyramidal stack
2225/06572 . . . . . . Auxiliary carrier between devices, the carrier having an electrical connection structure
2225/06575 . . . . . . Auxiliary carrier between devices, the carrier having no electrical connection structure
2225/06579 . . . . . . TAB carriers; beam leads
2225/06582 . . . . . . Housing for the assembly, e.g. chip scale package [CSP]
2225/06586 . . . . . . Thermal management, e.g. cooling
2225/06589 . . . . . . Mounting aids permanently on device; arrangements for alignment (use of temporary supports H01L 21/6835)
2225/06596 . . . . . . Structural arrangements for testing (testing or measuring during manufacture or treatment H01L 22/00); testing electrical properties or locating electrical faults G01R 31/00)
2225/10 . . . . . . the devices having separate containers
2225/1005 . . . . . . the devices being of a type provided for in group H01L 27/00
2225/1011 . . . . . . the containers being in a stacked arrangement
2225/1017 . . . . . . the lowermost container comprising a device support
2225/1023 . . . . . . the support being an insulating substrate
2225/1029 . . . . . . the support being a lead frame
2225/1035 . . . . . . the device being entirely enclosed by the support, e.g. high-density interconnect [HDI]
2225/1041 . . . . . . Special adaptations for top connections of the lowermost container, e.g. redistribution layer, integral interposer
2225/1047 . . . . . . Details of electrical connections between containers
2225/1052 . . . . . . Wire or wire-like electrical connections
2225/1058 . . . . . . Bump or bump-like electrical connections, e.g. balls, pillars, posts
2225/1064 . . . . . . Electrical connections provided on a side surface of one or more of the containers
2225/107 . . . . . . Indirect electrical connections, e.g. via an interposer, a flexible substrate, using TAB (printed circuits H05K 1/00)
2225/1076 . . . . . . Shape of the containers
2225/1082 . . . . . . for improving alignment between containers, e.g. interlocking features
2225/1088 . . . . . . Arrangements to limit the height of the assembly
2225/1094 . . . . . . Thermal management, e.g. cooling

2227/00 Indexing scheme for devices consisting of a plurality of semiconductor or other solid state components formed in or on a common substrate covered by group H01L 27/00
2227/32 . . . . . . Devices including an organic light emitting device [OLED], e.g. OLED display
2227/323 . . . . . . Multistep processes for AMOLED
2227/326 . . . . . . Use of temporary substrate, e.g. for manufacturing of OLED displays having an inorganic driving circuit

2229/00 Indexing scheme for semiconductor devices adapted for rectifying, amplifying, oscillating or switching, or capacitors or resistors with at least one potential-jump barrier or surface barrier, for details of semiconductor bodies or of electrodes thereof, or for multistep manufacturing processes therefor

2251/00 Indexing scheme relating to organic semiconductor devices covered by group H01L 51/00
2251/10 . . . . . . Processes specially adapted for the manufacture or treatment of organic semiconductor devices
2251/105 . . . . . . Patterning of a layer by embossing, e.g. to form trenches in an insulating layer
2251/30 . . . . . . Materials
2251/301 . . . . . . Inorganic materials
2251/303 . . . . . . Oxides, e.g. metal oxides
2251/305 . . . . . . Transparent conductive oxides [TCO]
2251/306 . . . . . . composed of tin oxides, e.g. F doped SnO
2251/308 . . . . . . composed of indium oxides, e.g. ITO
2251/50 . . . . . . Organic light emitting devices
2251/53 . . . . . . Structure
2251/5307 . . . . . . specially adapted for controlling the direction of light emission
2251/5315 . . . . . . Top emission
2251/5323 . . . . . . Two-side emission, i.e. TOLED
2251/533 . . . . . . End-face emission
2251/5333 . . . . . . Flexible OLED
2251/5346 . . . . . . Graded composition
2251/5353 . . . . . . Inverted OLED
2251/5361 . . . . . . OLED lamp
2251/5369 . . . . . . Nanoparticles used in whatever layer except emissive layer, e.g. in packaging
2251/5376 . . . . . . Combination of fluorescent and phosphorescent emission
2251/5384 . . . . . . Multiple hosts in the emissive layer
2251/5392 . . . . . . Short-circuit prevention
2251/55 . . . . . . characterised by parameters
2251/552 . . . . . . HOMO-LUMO-EF
2251/554 . . . . . . Oxidation-reduction potential
2251/556 . . . . . . Temperature
2251/558 . . . . . . Thickness
2251/56 . . . . . . Processes specially adapted for the manufacture or treatment of OLED
2251/562 . . . . . . Aging
2251/564 . . . . . . Application of alternating current
2251/566 . . . . . . Division of substrate, e.g. for manufacturing of OLED displays
2251/568 . . . . . . Repairing

2924/00 Indexing scheme for arrangements or methods for connecting or disconnecting semiconductor or solid-state bodies as covered by H01L 24/00
Chemical elements

- H01L 2924/0002
- Not covered by any one of groups H01L 24/00, H01L 24/00 and H01L 2224/00

- Chemical elements
  - Hydrogen [H]
  - Helium [He]
  - Lithium [Li]
  - Beryllium [Be]
  - Boron [B]
  - Carbon [C]
  - Nitrogen [N]
  - Oxygen [O]
  - Fluorine [F]
  - Neon [Ne]
  - Sodium [Na]
  - Magnesium [Mg]
  - Aluminum [Al]
  - Silicon [Si]
  - Phosphorus [P]
  - Sulfur [S]
  - Chlorine [Cl]
  - Argon [Ar]
  - Potassium [K]
  - Calcium [Ca]
  - Scandium [Sc]
  - Titanium [Ti]
  - Vanadium [V]
  - Chromium [Cr]
  - Manganese [Mn]
  - Iron [Fe]
  - Cobalt [Co]
  - Nickel [Ni]
  - Copper [Cu]
  - Zinc [Zn]
  - Gallium [Ga]
  - Germanium [Ge]
  - Arsenic [As]
  - Selenium [Se]
  - Bromine [Br]
  - Krypton [Kr]
  - Rubidium [Rb]
  - Strontium [Sr]
  - Yttrium [Y]
  - Zirconium [Zr]

- H01L 2924/0001
- Technical content checked by a classifier

NOTE
Codes H01L 2924/0001 - H01L 2924/0002 are used to describe the status of reclassification; they do not relate to technical features as such

- Not relevant to the scope of the group, the symbol of which is combined with the symbol of this group
- Relevant to the scope of the group, the symbol of which is combined with the symbol of this group
- Fully indexed content
- the subject-matter covered by the group, the symbol of which is combined with the symbol of this group, being disclosed without further technical details
- the subject-matter covered by the group, the symbol of which is combined with the symbol of this group, being disclosed as prior art

- Not covered by any one of groups H01L 24/00, H01L 24/00 and H01L 2224/00

- Rare earth metals
- Alkali metals
- Alkali earth metals
- Transition metals
- Refractory metals
- Groups of the periodic table

- Niobium [Nb]
- Molybdenum [Mo]
- Technetium [Tc]
- Ruthenium [Ru]
- Rhodium [Rh]
- Palladium [Pd]
- Silver [Ag]
- Cadmium [Cd]
- Indium [In]
- Tin [Sn]
- Antimony [Sb]
- Tellurium [Te]
- Iodine [I]
- Xenon [Xe]
- Cesium [Cs]
- Barium [Ba]
- Lanthanum [La]
- Cerium [Ce]
- Praseodymium [Pr]
- Neodymium [Nd]
- Promethium [Pm]
- Samarium [Sm]
- Europium [Eu]
- Gadolinium [Gd]
- Terbiun [Tb]
- Dysprosium [Dy]
- Holmium [Ho]
- Erbium [Er]
- Thulium [Tm]
- Ytterbium [Yb]
- Lutetium [Lu]
- Hafnium [Hf]
- Tantalum [Ta]
- Tungsten [W]
- Rhenium [Re]
- Osmium [Os]
- Iridium [Ir]
- Platinum [Pt]
- Gold [Au]
- Mercury [Hg]
- Thallium [Tl]
- Lead [Pb]
- Bismuth [Bi]
- Polonium [Po]
- Astatine [At]
- Radon [Rn]
- Francium [Fr]
- Radium [Ra]
- Actinium [Ac]
- Thorium [Th]
- Protactinium [Pa]
- Uranium [U]
- Neptunium [Np]
- Plutonium [Pu]
2924/0106 . . . Lanthanides, i.e. Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu
2924/0107 . . . Actinides, i.e. Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No, Lr
2924/0108 . . . Noble metals
2924/0109 . . . Metalloids or Semi-metals
2924/0111 . . . Chalcogens
2924/01111 . . . Halogens
2924/01112 . . . Noble gases
2924/012 . . . Semiconductor purity grades
2924/01201 . . . 1N purity grades, i.e. 90%
2924/01202 . . . 2N purity grades, i.e. 99%
2924/01203 . . . 3N purity grades, i.e. 99.9%
2924/01204 . . . 4N purity grades, i.e. 99.99%
2924/01205 . . . 5N purity grades, i.e. 99.999%
2924/01206 . . . 6N purity grades, i.e. 99.9999%
2924/01207 . . . 7N purity grades, i.e. 99.99999%
2924/01208 . . . 8N purity grades, i.e. 99.999999%
2924/013 . . . Alloys
2924/0132 . . . Binary Alloys
2924/01321 . . . Isomorphous Alloys
2924/01322 . . . Eutectic Alloys, i.e. obtained by a liquid transforming into two solid phases
2924/01323 . . . Hypoeutectic alloys i.e. with compositions lying to the left of the eutectic point
2924/01324 . . . Hypereutectic alloys i.e. with compositions lying to the right of the eutectic point
2924/01325 . . . Peritectic Alloys, i.e. obtained by a liquid and a solid transforming into a new and different solid phase
2924/01326 . . . Monocotixcs, i.e. obtained by a liquid transforming into a solid and a new and different liquid phase
2924/01327 . . . Intermediate phases, i.e. intermetallics compounds
2924/0133 . . . Ternary Alloys
2924/0134 . . . Quaternary Alloys
2924/0135 . . . Quinary Alloys
2924/014 . . . Solder alloys
2924/01402 . . . Invar, i.e. single-phase alloy of around 36% nickel and 64% iron
2924/01403 . . . Kovar, i.e. FeNiCo alloys
2924/01404 . . . Alloy 42, i.e. FeNi42
2924/01405 . . . Inovco, i.e. Fe-33Ni-4.5Co
2924/042 . . . Borides composed of metals from groups of the periodic table
2924/0421 . . . 1st Group
2924/0422 . . . 2nd Group
2924/0423 . . . 3rd Group
2924/0424 . . . 4th Group
2924/0425 . . . 5th Group
2924/0426 . . . 6th Group
2924/0427 . . . 7th Group
2924/0428 . . . 8th Group
2924/0429 . . . 9th Group
2924/044 . . . 10th Group
2924/0441 . . . 11th Group
2924/0442 . . . 12th Group
2924/0443 . . . 13th Group
2924/0444 . . . 14th Group
2924/0445 . . . Lanthanides
2924/0446 . . . Actinides
2924/0449 . . . being a combination of two or more materials provided in the groups H01L 2924/0421 - H01L 2924/0446
2924/04491 . . . having a monocrystalline microstructure
2924/04492 . . . having a polycrystalline microstructure
2924/04494 . . . having an amorphous microstructure, i.e. glass
2924/045 . . . Carbides composed of metals from groups of the periodic table
2924/0451 . . . 1st Group
2924/0452 . . . 2nd Group
2924/0453 . . . 3rd Group
2924/0454 . . . 4th Group
2924/04541 . . . TiC
2924/0455 . . . 5th Group
2924/0456 . . . 6th Group
2924/04563 . . . WC
2924/0457 . . . 7th Group
2924/0458 . . . 8th Group
2924/0459 . . . 9th Group
2924/046 . . . 10th Group
2924/0461 . . . 11th Group
2924/0462 . . . 12th Group
2924/0463 . . . 13th Group
2924/0464 . . . 14th Group
2924/04642 . . . SiC
2924/0465 . . . Lanthanides
2924/0466 . . . Actinides
2924/0469 . . . being a combination of two or more materials provided in the groups H01L 2924/0451 - H01L 2924/0466
2924/04691 . . . having a monocrystalline microstructure
2924/04692 . . . having a polycrystalline microstructure
2924/04694 . . . having an amorphous microstructure, i.e. glass
2924/047 . . . Silicides composed of metals from groups of the periodic table
2924/0471 . . . 1st Group
2924/0472 . . . 2nd Group
2924/0473 . . . 3rd Group
2924/0474 . . . 4th Group
2924/0475 . . . 5th Group
2924/0476 . . . 6th Group
2924/0477 . . . 7th Group
2924/0478 . . . 8th Group
2924/0479 . . . 9th Group
2924/048 . . . 10th Group
2924/0481 . . . 11th Group
2924/0482 . . . 12th Group
2924/0483 . . . 13th Group
2924/0484 . . . 14th Group
2924/0485 . . . Lanthanides
2924/0486 . . . Actinides
2924/0489 . . . being a combination of two or more materials provided in the groups H01L 2924/0471 - H01L 2924/0486
2924/04891 . . . having a monocrystalline microstructure
2924/04892 . . . having a polycrystalline microstructure
2924/04894 . . . having an amorphous microstructure, i.e. glass
2924/049 . . . Nitrides composed of metals from groups of the periodic table
2924/0491 . . . 1st Group
2924/0492 . . . 2nd Group
2924/0493 . . . 3rd Group
Oxides composed of metals from groups of the periodic table

Phosphides composed of metals from groups of the periodic table

having an amorphous microstructure, i.e. glass

H01L 2924/0511

Actinides

being a combination of two or more materials provided in the groups

H01L 2924/0511 - H01L 2924/0526

having a monocristalline microstructure

having a polycristalline microstructure

H01L 2924/05291 - H01L 2924/0526

having an amorphous microstructure, i.e. glass

oxidates composed of metals from groups of the periodic table

having an amorphous microstructure, i.e. glass

H01L 2924/0539

having an amorphous microstructure, i.e. glass

H01L 2924/0556 - H01L 2924/0559

having a monocristalline microstructure

having a polycristalline microstructure

H01L 2924/0571 - H01L 2924/0578

having an amorphous microstructure, i.e. glass

H01L 2924/0571 - H01L 2924/0586

Actinides

being a combination of two or more materials provided in the groups

H01L 2924/0511 - H01L 2924/0586

having a monocristalline microstructure

having a polycristalline microstructure

having an amorphous microstructure, i.e. glass

H01L 2924/05891 - H01L 2924/05892
having an amorphous microstructure, i.e. glass

being combinations of any of the materials from the groups H01L 2924/042 - H01L 2924/0584, e.g. oxynitrides

having a monocristalline microstructure

having a polycristalline microstructure

having an amorphous microstructure, i.e. glass

Polymers (polymers per se Cd8; polymer adhesives C9d)

Polyolefin polymer

Styrenic polymer

Halogenated polymer

Polyvinyl alchohol

Polyvinyl acetate

Acrylic polymer

Graft polymer

Block copolymer

ABS

Polycetal

Phenolic resin

Epoxy resin

Polyphenylene

Polyster

Polycarbonate

Polyether

Polurethane

Polymide

Polymide or polyimide

Polyamine

Polyamide

Sulfur containing polymer

Polysiloxane

Adhesive characteristics other than chemical

not being an ohmic electrical conductor

being an ohmic electrical conductor

Extrinsic, i.e. with electrical conductive fillers

Intrinsic, e.g. polyaniline [PANI]

being pressure sensitive

with a principal constituent of the material being a combination of two or more materials provided in the groups H01L 2924/013 - H01L 2924/0715

Glass epoxy laminates

FR-4

FR-5

G10

G11

Cermets, i.e. composite material composed of ceramic and metallic materials

Glass-ceramics, e.g. devitrified glass

Low temperature co-fired ceramic [LTCC]

Details of semiconductor or other solid state devices to be connected

Structure

Shape

being other than a cuboid

at the periphery

at the active surface

at the passive surface

being a cuboid

with a rectangular active surface

with a square active surface

being a sphere

Material of the semiconductor or solid state bodies

Semiconducting materials

Elemental semiconductors, i.e. Group IV

Germanium [Ge]

Silicon [Si]

Diamond [C]

Compound semiconductors

IV

Silicon-germanium [SiGe]

Silicon Carbide [SiC]

III-V

Aluminium antimonide [AlSb]

Aluminium arsenide [AlAs]

Aluminium nitride [AlN]

Aluminium phosphide [AlP]

Boron nitride [BN], e.g. cubic, hexagonal, nanotube

Boron phosphate [BP]

Boron arsenide [BAs, B12As2]

Gallium antimonide [GaSb]

Gallium arsenide [GaAs]

Gallium nitride [GaN]

Gallium phosphate [GaP]

Indium antimonide [InSb]

Indium arsenide [InAs]

Indium nitride [InN]

Indium phosphide [InP]

Aluminium gallium arsenide [AlGaAs]

Indium gallium arsenide [InGaAs]

Indium gallium nitride [InGaAsN]

Gallium arsenide nitride [GaAsN]

Indium arsenide nitride [InAsN]

Aluminium gallium nitride [AlGaN]

Aluminium gallium phosphide [AlGaP]

Indium gallium nitride [InGaP]

Indium gallium arsenide nitride [InAsP]

Aluminium indium arsenide [AlInAs]

Aluminium indium nitride [AlInN]

Aluminium indium antimonide [AlInSb]

Aluminium indium antimonide [InAsSb]
2924/10359 . . . . Gallium indium nitride arsenide antimonide [GaInNAsSb]
2924/1036 . . . . Gallium indium arsenide antimonide phosphate [GaInAsSbP]
2924/1037 . . . . II-VI
2924/10371 . . . . Cadmium selenide [CdSe]
2924/10372 . . . . Cadmium sulfide [CdS]
2924/10373 . . . . Cadmium telluride [CdTe]
2924/10375 . . . . Zinc selenide [ZnSe]
2924/10376 . . . . Zinc sulfide [ZnS]
2924/10377 . . . . Zinc telluride [ZnTe]
2924/10378 . . . . Cadmium zinc telluride, i.e. CZT [CdZnTe]
2924/10379 . . . . Mercury cadmium telluride [HgZnTe]
2924/1038 . . . . Mercury zinc telluride [HgZnSe]
2924/10381 . . . . Mercury zinc selenide [HgZnSe]
2924/1042 . . . . I-VII
2924/10421 . . . . Cuprous chloride [CuCl]
2924/1047 . . . . IV-VI
2924/10471 . . . . Copper sulfide [CuS]
2924/1052 . . . . Lead selenide [PbSe]
2924/10522 . . . . Lead(II)sulfide [PbS]
2924/10523 . . . . Lead telluride [PbTe]
2924/10524 . . . . Tin sulfide [SnS, SnS2]
2924/10525 . . . . Tin telluride [SnTe]
2924/10526 . . . . Lead telluride [PbSnTe]
2924/10527 . . . . Thallium tin telluride [TlSnTe3]
2924/10528 . . . . Thallium germanium telluride [Tl2GeTe3]
2924/1057 . . . . V-VI
2924/10571 . . . . Bismuth telluride [Bi2Te3]
2924/1062 . . . . II-V
2924/10621 . . . . Cadmium phosphide [CdP2]
2924/10622 . . . . Cadmium arsenide [CdAs2]
2924/10623 . . . . Cadmium antimonide [CdSb2]
2924/10624 . . . . Zinc phosphide [ZnP2]
2924/10625 . . . . Zinc arsenide [ZnAs2]
2924/10626 . . . . Zinc antimonide [ZnSb2]
2924/1067 . . . . Oxide
2924/10671 . . . . Titanium dioxide, anatase, rutile, brookite [TiO2]
2924/10672 . . . . Copper(I)oxide [Cu2O]
2924/10673 . . . . Copper(II)oxide [CuO]
2924/10674 . . . . Uranium dioxide [UO2]
2924/10675 . . . . Uranium trioxide [UO3]
2924/10676 . . . . Bismuth trioxide [Bi2O3]
2924/10677 . . . . Tin dioxide [SnO2]
2924/10678 . . . . Barium titanate [BaTiO3]
2924/10679 . . . . Strontium titanate [SrTiO3]
2924/1068 . . . . Lithium niobate [LiNbO3]
2924/10681 . . . . Lanthanum copper oxide [La2CuO4]
2924/1072 . . . . Layered
2924/10721 . . . . Lead(II)iodide [PbI2]
2924/10722 . . . . Molybdenum disulfide [MoS2]
2924/10723 . . . . Gallium selenide [GaSe]
2924/10724 . . . . Tin sulfide [SnS]
2924/10725 . . . . Bismuth sulfide [Bi2S3]
2924/1077 . . . . Magnetic diluted [DMS]
2924/10771 . . . . Gallium manganese arsenide [GaMnAs]
H01L.  

2924/13022 . . . . . . . MA-GTO - Modified Anode Gate Turn-Off thyristor  
2924/13023 . . . . . . . IGCT - Integrated Gate Commutated Thyristor  
2924/13024 . . . . . . . LASCr - Light Activated SCR, or LTT - Light triggered thyristor  
2924/13025 . . . . . . . Light Activated Semiconductor Switch [LASS]  
2924/13026 . . . . . . . MCT - MOSFET Controlled Thyristor - It contains two additional FET structures for on/off control  
2924/13027 . . . . . . . BRT - Base Resistance Controlled Thyristor  
2924/13028 . . . . . . . RCT - Reverse Conducting Thyristor  
2924/13029 . . . . . . . PUT or PUJT - Programmable Unijunction Transistor - A thyristor with gate on n-type layer near to the anode used as a functional replacement for unijunction transistor  
2924/1303 . . . . . . . SCS - Silicon Controlled Switch or Thyristor Tetrode - A thyristor with both cathode and anode gates  
2924/13032 . . . . . . . STh - Static Induction Thyristor, or FCTh - Field Controlled Thyristor - containing a gate structure that can shut down anode current flow  
2924/13033 . . . . . . . TRIAC - Triode for Alternating Current - A bidirectional switching device containing two thyristor structures with common gate contact  
2924/13034 . . . . . . . Silicon Controlled Rectifier [SCR]  
2924/13035 . . . . . . . Asymmetrical SCR [ASCR]  
2924/1304 . . . . . . . Transistor  
2924/1305 . . . . . . . Bipolar Junction Transistor [BJT]  
2924/13051 . . . . . . . Heterojunction bipolar transistor [HBT]  
2924/13052 . . . . . . . Schottky transistor  
2924/13053 . . . . . . . Avalanche transistor  
2924/13054 . . . . . . . Darlington transistor  
2924/13055 . . . . . . . Insulated gate bipolar transistor [IGBT]  
2924/13056 . . . . . . . Photo transistor  
2924/1306 . . . . . . . Field-effect transistor [FET]  
2924/13061 . . . . . . . Carbon nanotube field-effect transistor [CNFET]  
2924/13062 . . . . . . . Junction field-effect transistor [JFET]  
2924/13063 . . . . . . . Metal-Semiconductor Field-Effect Transistor [MESFET]  
2924/13064 . . . . . . . High Electron Mobility Transistor [HEMT, HFET [heterostructure FET], MODFET]  
2924/13066 . . . . . . . Inverted-T field effect transistor [ITFET]  
2924/13067 . . . . . . . FinFET, source/drain region shapes fins on the silicon surface  
2924/13068 . . . . . . . Fast-reverse epitaxial diode field-effect transistor [FREDFET]  
2924/13069 . . . . . . . Thin film transistor [TFT]  
2924/1307 . . . . . . . Organic Field-Effect Transistor [OFET]  
2924/13071 . . . . . . . Ballistic transistor  
2924/13072 . . . . . . . Sensor FET  
2924/13073 . . . . . . . ion-sensitive field-effect transistor [ISFET]  
2924/13074 . . . . . . . Electrolyte-oxide-semiconductor field effect transistor [EOSFET], e.g. Neurochip  

2924/13075 . . . . . . . Deoxyribonucleic acid field-effect transistor [DNAFET]  
2924/13076 . . . . . . . DEPFET  
2924/13078 . . . . . . . Unijunction transistors  
2924/13079 . . . . . . . Single-electron transistors [SET]  
2924/1308 . . . . . . . Nanofluidic transistor  
2924/13081 . . . . . . . Multigate devices  
2924/13082 . . . . . . . Tetrode transistor  
2924/13083 . . . . . . . Pentode transistor  
2924/13084 . . . . . . . Trigate transistor  
2924/13085 . . . . . . . Dual gate FETs  
2924/13086 . . . . . . . Junctionless Nanowire Transistor [JNT]  
2924/13087 . . . . . . . Vertical-Slit Field-Effect Transistor [VeFET]  
2924/13088 . . . . . . . Graphene Nanoribbon Field-Effect Transistor [GNFET]  
2924/13089 . . . . . . . Nanoparticle Organic Memory Field-Effect Transistor [NOMFET]  
2924/1309 . . . . . . . Modulation-Doped Field Effect Transistor [MODFET]  
2924/13091 . . . . . . . Metal-Oxide-Doped Field Effect Transistor [MOSFET]  
2924/13092 . . . . . . . Dual Gate Metal-Oxide-Semiconductor Field-Effect Transistor [DGMOSFET]  

2924/14 . . . . . . . Integrated circuits  
2924/141 . . . . . . . Analog devices  
2924/142 . . . . . . . HF devices  
2924/1421 . . . . . . . RF devices  
2924/14211 . . . . . . . Voltage-controlled oscillator [VCO]  
2924/14215 . . . . . . . Low-noise amplifier [LNA]  
2924/1422 . . . . . . . Mixer  
2924/14221 . . . . . . . Electronic mixer  
2924/14222 . . . . . . . Frequency mixer  
2924/1423 . . . . . . . Monolithic Microwave Integrated Circuit [MMIC]  
2924/1424 . . . . . . . Operational amplifier  
2924/1425 . . . . . . . Converter  
2924/14251 . . . . . . . Frequency converter  
2924/14252 . . . . . . . Voltage converter  
2924/14253 . . . . . . . Digital-to-analog converter [DAC]  
2924/1426 . . . . . . . Driver  
2924/1427 . . . . . . . Voltage regulator [VR]  
2924/143 . . . . . . . Digital devices  
2924/1431 . . . . . . . Logic devices  
2924/1432 . . . . . . . Central processing unit [CPU]  
2924/1433 . . . . . . . Application-specific integrated circuit [ASIC]  
2924/14335 . . . . . . . Digital signal processor [DSP]  
2924/1434 . . . . . . . Memory  
2924/1435 . . . . . . . Random access memory [RAM]  
2924/1436 . . . . . . . Dynamic random-access memory [DRAM]  
2924/14361 . . . . . . . Synchronous dynamic random access memory [SDRAM]  
2924/14362 . . . . . . . RAS Only Refresh [ROR]  
2924/14363 . . . . . . . CAS before RAS refresh [CBR]  
2924/14364 . . . . . . . Multibank DRAM [MDRAM]  
2924/14365 . . . . . . . Video DRAM [VRAM]  
2924/14366 . . . . . . . Window DRAM [WRAM]  
2924/14367 . . . . . . . Fast page mode DRAM [FPDMDRAM]  

CPC - 2019.08  

175
H01L

2924/14368 . . . . . . . . . . . . Extended data out DRAM [EDO DRAM]
2924/14369 . . . . . . . . . . . . Burst EDO DRAM [BEDO DRAM]
2924/1437 . . . . . . . . . . . . Static random-access memory [SRAM]
2924/1438 . . . . . . . . . . . . Flash memory
2924/1441 . . . . . . . . . . . . Ferroelectric RAM [FeRAM or FRAM]
2924/1442 . . . . . . . . . . . . Synchronous graphics RAM [SGRAM]
2924/1443 . . . . . . . . . . . . Non-volatile random-access memory [NVRAM]
2924/1444 . . . . . . . . . . . . PBRAM
2924/145 . . . . . . . . . . . . Read-only memory [ROM]
2924/1451 . . . . . . . . . . . . EPROM
2924/14511 . . . . . . . . . . . . EEPROM
2924/1453 . . . . . . . . . . . . PROM
2924/146 . . . . . . Mixed devices
2924/1461 . . . . . . . . . . . . MEMS
2924/15 . . . . . . . . . . . . Details of package parts other than the semiconductor or other solid state devices to be connected
2924/151 . . . . . . . . . . . . Die mounting substrate
2924/1511 . . . . . . . . . . . . Structure
2924/1515 . . . . . . . . . . . . Shape
2924/15151 . . . . . . . . . . . . the die mounting substrate comprising an aperture, e.g. for underfilling, outgassing, window type wire connections
2924/15153 . . . . . . . . . . . . the die mounting substrate comprising a recess for hosting the device
2924/15155 . . . . . . . . . . . . the shape of the recess being other than a cuboid
2924/15156 . . . . . . . . . . . . Side view
2924/15157 . . . . . . . . . . . . Top view
2924/15158 . . . . . . . . . . . . the die mounting substrate being other than a cuboid
2924/15159 . . . . . . . . . . . . Side view
2924/15162 . . . . . . . . . . . . Top view
2924/15165 . . . . . . . . . . . . Monolayer substrate
2924/1517 . . . . . . . . . . . . Multilayer substrate
2924/15172 . . . . . . . . . . . . Fan-out arrangement of the internal vias
2924/15173 . . . . . . . . . . . . in a single layer of the multilayer substrate
2924/15174 . . . . . . . . . . . . in different layers of the multilayer substrate
2924/15182 . . . . . . . . . . . . Fan-in arrangement of the internal vias
2924/15183 . . . . . . . . . . . . in a single layer of the multilayer substrate
2924/15184 . . . . . . . . . . . . in different layers of the multilayer substrate
2924/15192 . . . . . . . . . . . . Resurf arrangement of the internal vias
2924/152 . . . . . . . . . . . . Disposition
2924/153 . . . . . . . . . . . . Connection portion
2924/1531 . . . . . . . . . . . . the connection portion being formed only on the surface of the substrate opposite to the die mounting surface
2924/15311 . . . . . . . . . . . . being a ball array, e.g. BGA
2924/15312 . . . . . . . . . . . . being a pin array, e.g. PGA
2924/15313 . . . . . . . . . . . . being a land array, e.g. LGA
2924/1532 . . . . . . . . . . . . the connection portion being formed on the die mounting surface of the substrate
2924/15321 . . . . . . . . . . . . being a ball array, e.g. BGA
2924/15322 . . . . . . . . . . . . being a pin array, e.g. PGA
2924/15323 . . . . . . . . . . . . being a land array, e.g. LGA
2924/1533 . . . . . . . . . . . . the connection portion being formed both on the die mounting surface of the substrate and outside the die mounting surface of the substrate
2924/15331 . . . . . . . . . . . . being a ball array, e.g. BGA
2924/15332 . . . . . . . . . . . . being a pin array, e.g. PGA
2924/15333 . . . . . . . . . . . . being a land array, e.g. LGA
2924/1546 . . . . . . . . . . . . Material
2924/157 . . . . . . . . . . . . with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof
2924/15701 . . . . . . . . . . . . the principal constituent melting at a temperature of less than 400 C
2924/15717 . . . . . . . . . . . . the principal constituent melting at a temperature of greater than or equal to 400 C and less than 950 C
2924/15724 . . . . . . . . . . . . Aluminium [Al] as principal constituent
2924/15738 . . . . . . . . . . . . the principal constituent melting at a temperature of greater than 950 C and less than 1550 C
2924/15786 . . . . . . . . . . . . with a principal constituent of the material being a non metallic, non metalloid inorganic material
2924/15787 . . . . . . . . . . . . Ceramics, e.g. crystalline carbides, nitrides or oxides
2924/15788 . . . . . . . . . . . . Glasses, e.g. amorphous oxides, nitrides or fluorides
2924/1579 . . . . . . . . . . . . with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy
2924/15791 . . . . . . . . . . . . The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene
2924/15793 . . . . . . . . . . . . with a principal constituent of the material being a solid not provided for in groups H01L 2924/157 - H01L 2924/15791, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond
2924/15798 . . . . . . . . . . . . with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams
2924/161 . . . . . . . . . . . . Cap
2924/1611 . . . . . . . . . . . . Structure
2924/1615 . . . . . . . . . . . . Shape
2924/16151 . . . . . . . . . . . . Cap comprising an aperture, e.g. for pressure control, encapsulation
2924/16152 . . . . . . . . . . . . Cap comprising a cavity for hosting the device, e.g. U-shaped cap
2924/16153 . . . . . . . . . . . . Cap enclosing a plurality of side-by-side cavities [e.g. E-shaped cap]
2924/1616 . . . . . . . . . . . . Cavity shape
2924/1617 . . . . . . . . . . . . Cavity coating
2924/16171 . . . . . . . . . . . . Material
with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

with a principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrides or oxides (glass ceramics H01L 2224/16175)

Glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2924/157 - H01L 2924/15791, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

Connection portion, e.g. seal

Material

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

with a principal constituent of the material being a solid not provided for in groups H01L 2924/157 - H01L 2924/15791, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

Connection portion, e.g. seal

Material

thef principal constituent melting at a temperature of greater than 400 C and less than 950 C

Aluminium [Al] as principal constituent

the principal constituent melting at a temperature of greater than or equal to 950 C

Copper [Cu] as principal constituent

Iron [Fe] as principal constituent

the principal constituent melting at a temperature of greater than 1550 C

with a principal constituent of the material being a non metallic, non metalloid inorganic material

Ceramics, e.g. crystalline carbides, nitrides or oxides

Glasses, e.g. amorphous oxides, nitrides or fluorides

with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

with a principal constituent of the material being a solid not provided for in groups H01L 2924/167 - H01L 2924/16791, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

Connection portion, e.g. seal

Material
2924/177 . . . with a principal constituent of the material being a metal or a metalloid, e.g. boron [B], silicon [Si], germanium [Ge], arsenic [As], antimony [Sb], tellurium [Te] and polonium [Po], and alloys thereof

2924/17701 . . . . the principal constituent melting at a temperature of less than 400 C

2924/17717 . . . . the principal constituent melting at a temperature of greater than or equal to 400 C and less than 950 C

2924/17724 . . . . Aluminium [Al] as principal constituent

2924/17738 . . . . the principal constituent melting at a temperature of greater than or equal to 950 C and less than 1550 C

2924/17747 . . . . Copper [Cu] as principal constituent

2924/1776 . . . . Iron [Fe] as principal constituent

2924/17763 . . . . the principal constituent melting at a temperature of greater than 1550 C

2924/17786 . . . . with a principal constituent of the material being a non metallic, non metalloid inorganic material

2924/17787 . . . . Ceramics, e.g. crystalline carbides, nitrides or oxides

2924/17788 . . . . Glasses, e.g. amorphous oxides, nitrides or fluorides

2924/1779 . . . . with a principal constituent of the material being a polymer, e.g. polyester, phenolic based polymer, epoxy

2924/17791 . . . . The principal constituent being an elastomer, e.g. silicones, isoprene, neoprene

2924/17793 . . . . with a principal constituent of the material being a solid not provided for in groups H01L 2924/177 - H01L 2924/17791, e.g. allotropes of carbon, fullerene, graphite, carbon-nanotubes, diamond

2924/17798 . . . . with a principal constituent of the material being a combination of two or more materials in the form of a matrix with a filler, i.e. being a hybrid material, e.g. segmented structures, foams

2924/181 . . . . Encapsulation

2924/1811 . . . . Structure

2924/1815 . . . . Shape

2924/1816 . . . . Exposing the passive side of the semiconductor or solid-state body

2924/18161 . . . . of a flip chip

2924/18162 . . . . of a chip with build-up interconnect

2924/18165 . . . . of a wire bonded chip

2924/182 . . . . Disposition

2924/183 . . . . Connection portion, e.g. seal

2924/18301 . . . . being an anchoring portion, i.e. mechanical interlocking between the encapsulation resin and another package part

2924/186 . . . . Material

2924/19 . . . . Details of hybrid assemblies other than the semiconductor or other solid state devices to be connected

2924/1901 . . . . Structure

2924/19011 . . . . including integrated passive components

2924/19015 . . . . including thin film passive components

2924/1902 . . . . including thick film passive components

2924/1903 . . . . including wave guides

2924/19031 . . . . being a strip line type

2924/19032 . . . . being a microstrip line type

2924/19033 . . . . being a coplanar line type

2924/19038 . . . . being a hybrid line type

2924/19039 . . . . impedance transition between different types of wave guides

2924/1904 . . . . Component type

2924/19041 . . . . being a capacitor

2924/19042 . . . . being an inductor

2924/19043 . . . . being a resistor

2924/1905 . . . . Shape

2924/19051 . . . . Impedance matching structure [e.g. balun]

2924/191 . . . . Disposition

2924/19101 . . . . of discrete passive components

2924/19102 . . . . in a stacked assembly with the semiconductor or solid state device

2924/19103 . . . . interposed between the semiconductor or solid-state device and the die mounting substrate, i.e. chip-on-passive

2924/19104 . . . . on the semiconductor or solid-state device, i.e. passive-on-chip

2924/19105 . . . . in a side-by-side arrangement on a common die mounting substrate

2924/19106 . . . . in a mirrored arrangement on two different sides of a common die mounting substrate

2924/19107 . . . . off-chip wires

2924/20 . . . . Parameters

2924/201 . . . . Temperature ranges

2924/20101 . . . . Temperature range T<0 C, T<273.15 K

2924/20102 . . . . Temperature range 0 C=T<60 C, 273.15 K

2924/20103 . . . . Temperature range 60 C=T<100 C, 333.15 K

2924/20104 . . . . Temperature range 100 C=T<150 C, 373.15 K

2924/20105 . . . . Temperature range 150 C=T<200 C, 423.15 K

2924/20106 . . . . Temperature range 200 C=T<250 C, 473.15 K

2924/20107 . . . . Temperature range 250 C=T<300 C, 523.15 K

2924/20108 . . . . Temperature range 300 C=T<350 C, 573.15 K

2924/20109 . . . . Temperature range 350 C=T<400 C, 623.15 K

2924/2011 . . . . Temperature range 400 C=T<450 C, 673.15 K

2924/20111 . . . . Temperature range 450 C=T<500 C, 723.15 K

2924/202 . . . . Electromagnetic wavelength ranges [W]

2924/20201 . . . . Gamma radiation, i.e. wavelength less than 0.01 nm

2924/20202 . . . . X-ray radiation, i.e. wavelength 0.01 to 10 nm

2924/2021 . . . . Ultraviolet radiation

2924/20211 . . . . UV-C 100=W<280 nm

2924/20212 . . . . UV-B 280=W<315 nm

2924/20213 . . . . UV-A 315=W<400 nm

2924/2024 . . . . Visible spectrum wavelength 390=W<700 nm, i.e. 400-790 THz

2924/2026 . . . . Infrared radiation 700=W<3000 nm

2924/20261 . . . . IR-A 700=W<1400 nm, i.e. 215 THz-430 THz

2924/20262 . . . . IR-B 1400=W<3000 nm, i.e. 100THz-215 THz
Diameter ranges

Length ranges

Ultrasonic frequency ranges, i.e. KHz

- larger or equal to 20 microns less than 30 microns
- larger or equal to 10 microns less than 20 microns
- larger or equal to 1 micron less than 10 microns
- larger or equal to 7000 microns less than 8000 microns
- larger or equal to 6000 microns less than 7000 microns
- larger or equal to 4000 microns less than 5000 microns
- larger or equal to 3000 microns less than 4000 microns
- larger or equal to 2500 microns less than 3000 microns
- larger or equal to 2000 microns less than 2500 microns
- larger or equal to 1500 microns less than 2000 microns
- larger or equal to 1000 microns less than 1500 microns
- larger or equal to 500 microns less than 600 microns
- larger or equal to 400 microns less than 500 microns
- larger or equal to 300 microns less than 400 microns
- larger or equal to 200 microns less than 300 microns
- larger or equal to 100 microns less than 200 microns
- larger or equal to 1 micron less than 100 microns
- larger or equal to 90 microns less than 100 microns
- larger or equal to 80 microns less than 90 microns
- larger or equal to 70 microns less than 80 microns
- larger or equal to 60 microns less than 70 microns
- larger or equal to 50 microns less than 60 microns
- larger or equal to 40 microns less than 50 microns
- larger or equal to 30 microns less than 40 microns

Radio 1 mm - km 300 GHz - 3 Hz

Microwave radiation 1 mm - 1 meter, i.e. 300 GHz - 300 MHz

Thermal stress

Electromagnetic shielding

Thermal radiation

Ultrasonic frequency [f] f=25 kHz

Ultrasonic frequency [f] 175 Khz=<f< 200 kHz

Ultrasonic frequency [f] 125 Khz=<f< 150 kHz

Ultrasonic frequency [f] 150 Khz=<f< 175 kHz

Ultrasonic frequency [f] 175 Khz=<f< 200 kHz

Ultrasonic frequency [f] f>=200 KHz

Ultrasonic frequency [f] 175 Khz=<f< 200 kHz

Ultrasonic frequency [f] f<25 kHz

Ultrasonic frequency [f] 175 Khz=<f< 200 kHz

Ultrasonic frequency [f] 125 Khz=<f< 150 kHz

Ultrasonic frequency [f] f>=200 KHz

Ultrasonic frequency [f] 175 Khz=<f< 200 kHz

Ultrasonic frequency [f] f<25 kHz

Ultrasonic frequency [f] 175 Khz=<f< 200 kHz

Ultrasonic frequency [f] f>=200 KHz

Ultrasonic frequency [f] 175 Khz=<f< 200 kHz

Ultrasonic frequency [f] f<25 kHz

Ultrasonic frequency [f] 175 Khz=<f< 200 kHz

Ultrasonic frequency [f] f>=200 KHz

Ultrasonic frequency [f] 175 Khz=<f< 200 kHz

Ultrasonic frequency [f] f<25 kHz
Hydrogen Fluoride [HF] LASER
Dye laser
being a gas
argon-ion LASER
CO₂ LASER
HeAg LASER
HeNe LASER
NeCu LASER
being an Excimer
ArF LASER
F₂ LASER
KrCl LASER
KrF LASER
XeCl LASER
XeF LASER
being a fiber hosted LASER
being a solid state
Free electron LASER
Photonic crystal LASER
Fiber solid state LASER
Yttrium Aluminium Garnet Nd:YAG LASER
Yttrium Lithium Flouride Nd:YLF LASER
Ruby LASER
Yb:YAG LASER
Wavelength
UV spectrum
Visible spectrum
IR spectrum
Details relating to devices covered by the group H01L 33/00 but not provided for in its subgroups
Processes
relating to electrodes
relating to coatings
relating to semiconductor body packages
relating to wavelength conversion elements
relating to encapsulations
relating to optical field-shaping elements
relating to arrangements for conducting electric current to or from the semiconductor body
relating to heat extraction or cooling elements
Periodic patterns for optical field-shaping in or on the semiconductor body or semiconductor body package, e.g. photonic bandgap structures
Scattering means in or on the semiconductor body or semiconductor body package (H01L 33/22 takes precedence)