CPC COOPERATIVE PATENT CLASSIFICATION

H ELECTRICITY

(NOTE omitted)

H10 SEMICONDUCTOR DEVICES; ELECTRIC SOLID-STATE DEVICES NOT OTHERWISE PROVIDED FOR

H10N ELECTRIC SOLID-STATE DEVICES NOT OTHERWISE PROVIDED FOR

NOTE

In this subclass, the periodic system used is the I to VIII group system indicated in the Periodic Table under Note (3) of section C.

Thermoelectric or thermomagnetic devices

10/00 **Thermoelectric devices comprising a junction of dissimilar materials, i.e. devices exhibiting Seebeck or Peltier effects** (integrated devices or assemblies of multiple devices H10N 19/00)

10/01 . Manufacture or treatment

10/10 . operating with only the Peltier or Seebeck effects

10/13 . . characterised by the heat-exchanging means at the junction

10/17 . . characterised by the structure or configuration of the cell or thermocouple forming the device

10/80 . Constructional details

10/81 . . Structural details of the junction

10/813 . . . the junction being separable, e.g. using a spring

10/817 . . . the junction being non-separable, e.g. being cemented, sintered or soldered

10/82 . . Connection of interconnections

10/85 . . Thermoelectric active materials

10/851 . . . comprising inorganic compositions

10/852 . . . . comprising tellurium, selenium or sulfur

10/853 . . . . comprising arsenic, antimony or bismuth (H10N 10/852 takes precedence)

10/854 . . . . comprising only metals (H10N 10/852, H10N 10/853 take precedence)

10/855 . . . . comprising compounds containing boron, carbon, oxygen or nitrogen

WARNING

Group H10N 10/855 is impacted by reclassification into group H10N 10/8556.

Groups H10N 10/855 and H10N 10/8556 should be considered in order to perform a complete search.

10/8552 . . . . . {the compounds being superconducting}

10/8556 . . . . {comprising compounds containing germanium or silicon}

WARNING

Group H10N 10/8556 is incomplete pending reclassification of documents from group H10N 10/855.

Groups H10N 10/855 and H10N 10/8556 should be considered in order to perform a complete search.

10/856 . . . comprising organic compositions

10/857 . . . comprising compositions changing continuously or discontinuously inside the material

15/00 **Thermoelectric devices without a junction of dissimilar materials; Thermomagnetic devices, e.g. using the Nernst-Ettingshausen effect** (integrated devices or assemblies of multiple devices H10N 19/00)

15/10 . Thermoelectric devices using thermal change of the dielectric constant, e.g. working above and below the Curie point

15/15 . . {Thermoelectric active materials}

15/20 . Thermomagnetic devices using thermal change of the magnetic permeability, e.g. working above and below the Curie point

19/00 **Integrated devices, or assemblies of multiple devices, comprising at least one thermoelectric or thermomagnetic element covered by groups H10N 10/00 - H10N 15/00**

WARNING

Group H10N 19/00 is incomplete pending reclassification of documents from groups H01L 25/04, H01L 25/065, H01L 25/0652, H01L 25/0655, H01L 25/0657, H01L 25/16, H01L 25/162, H01L 25/165, H01L 25/167 and H01L 25/18.

All groups listed in this Warning should be considered in order to perform a complete search.

19/101 . {Multiple thermocouples connected in a cascade arrangement}

Piezoelectric, electrostrictive or magnetostrictive devices

30/00 **Piezoelectric or electrostrictive devices** (integrated devices or assemblies of multiple devices H10N 39/00)

WARNING

Group H10N 30/00 is impacted by reclassification into group H10N 35/00.

Groups H10N 30/00 and H10N 35/00 should be considered in order to perform a complete search.

30/01 . Manufacture or treatment

30/02 . . Forming enclosures or casings
30/03 . . Assembling devices that include piezoelectric or electrostrictive parts
30/04 . . Treatments to modify a piezoelectric or electrostrictive property, e.g. polarisation characteristics, vibration characteristics or mode tuning
30/045 . . . by polarising
30/05 . . Manufacture of multilayered piezoelectric or electrostrictive devices, or parts thereof, e.g. by stacking piezoelectric bodies and electrodes
30/053 . . . by integrally sintering piezoelectric or electrostrictive bodies and electrodes
30/057 . . . by stacking bulk piezoelectric or electrostrictive bodies and electrodes
30/06 . . Forming electrodes or interconnections, e.g. leads or terminals
30/063 . . . Forming interconnections, e.g. connection electrodes of multilayered piezoelectric or electrostrictive parts
30/067 . . . Forming single-layered electrodes of multilayered piezoelectric or electrostrictive parts
30/07 . . Forming of piezoelectric or electrostrictive parts or bodies on an electrical element or another base
30/071 . . . Mounting of piezoelectric or electrostrictive parts together with semiconductor elements, or other circuit elements, on a common substrate
30/072 . . . by laminating or bonding of piezoelectric or electrostrictive bodies
30/073 . . . . by fusion of metals or by adhesives
30/074 . . . by depositing piezoelectric or electrostrictive layers, e.g. aerosol or screen printing
30/076 . . . . by vapour phase deposition
30/077 . . . . by liquid phase deposition
30/078 . . . . . by sol-gel deposition
30/079 . . . . using intermediate layers, e.g. for growth control
30/08 . . Shaping or machining of piezoelectric or electrostrictive bodies
30/081 . . . by coating or depositing using masks, e.g. lift-off
30/082 . . . by etching, e.g. lithography
30/084 . . . by moulding or extrusion
30/085 . . . by machining
30/086 . . . . by polishing or grinding
30/088 . . . . by cutting or dicing
30/089 . . . . by punching
30/09 . . Forming piezoelectric or electrostrictive materials
30/092 . . . Forming composite materials
30/093 . . . Forming inorganic materials
30/095 . . . . by melting
30/097 . . . . by sintering
30/098 . . . Forming organic materials
30/101 . {with electrical and mechanical input and output, e.g. having combined actuator and sensor parts}
30/20 . with electrical input and mechanical output, e.g. functioning as actuators or vibrators
30/202 . . {using longitudinal or thickness displacement combined with bending, shear or torsion displacement}
30/2023 . . . {having polygonal or rectangular shape}
30/2027 . . . {having cylindrical or annular shape}
30/204 . . {using bending displacement, e.g. unimorph, bimorph or multimorph cantilever or membrane benders}
30/2041 . . . {Beam type}
30/2042 . . . . {Cantilevers, i.e. having one fixed end}
30/2043 . . . . . {connected at their free ends, e.g. parallelogram type}
30/2044 . . . . . {having multiple segments mechanically connected in series, e.g. zig-zag type}
30/2045 . . . . . {adapted for in-plane bending displacement}
30/2046 . . . . . {adapted for multi-directional bending displacement}
30/2047 . . . {Membrane type}
30/2048 . . . . {having non-planar shape}
30/206 . . {using only longitudinal or thickness displacement, e.g. d_{33} or d_{31} type devices}
30/208 . . {using shear or torsion displacement, e.g. d_{15} type devices}
30/30 . with mechanical input and electrical output, e.g. functioning as generators or sensors
30/302 . . {Sensors}
30/304 . . {Beam type}
30/306 . . . {Cantilevers}
30/308 . . {Membrane type}
30/40 . with electrical input and electrical output, e.g. functioning as transformers
30/50 . having a stacked or multilayer structure
30/501 . . {having a non-rectangular cross-section in a plane parallel to the stacking direction, e.g. polygonal or trapezoidal in side view}
30/503 . . {having a non-rectangular cross-section in a plane orthogonal to the stacking direction, e.g. polygonal or circular in top view}
30/505 . . . {the cross-section being annular}
30/506 . . {having a cylindrical shape and having stacking in the radial direction, e.g. coaxial or spiral type rolls}
30/508 . . {adapted for alleviating internal stress, e.g. cracking control layers}
30/60 . having a coaxial cable structure
30/702 . {based on piezoelectric or electrostrictive fibres}
30/704 . {based on piezoelectric or electrostrictive films or coatings}
30/706 . . {characterised by the underlying bases, e.g. substrates}
30/708 . . . {Intermediate layers, e.g. barrier, adhesion or growth control buffer layers}
30/80 . Constructional details

WARNING

Group H10N 30/80 is impacted by reclassification into group H10N 35/80.

Groups H10N 30/80 and H10N 35/80 should be considered in order to perform a complete search.

30/802 . . {Circuitry or processes for operating piezoelectric or electrostrictive devices not otherwise provided for, e.g. drive circuits}
30/804 . . . {for piezoelectric transformers}

30/85 . . Piezoelectric or electrostrictive active materials

WARNING

Group H10N 30/85 is impacted by reclassification into group H10N 35/85.

Groups H10N 30/85 and H10N 35/85 should be considered in order to perform a complete search.

30/852 . . . {Composite materials, e.g. having 1-3 or 2-2 type connectivity}
30/853 . . . Ceramic compositions
30/8536 . . . . {Alkaline earth metal based oxides, e.g. barium titanates}
30/8542 . . . . {Alkali metal based oxides, e.g. lithium, sodium or potassium niobates}
30/8548 . . . . {Lead-based oxides}
30/8554 . . . . . {Lead-zirconium titanate [PZT] based}
30/8561 . . . . {Bismuth-based oxides}
30/857 . . . Macromolecular compositions
30/87 . . Electrodes or interconnections, e.g. leads or terminals
30/871 . . . {Single-layered electrodes of multilayer piezoelectric or electrostrictive devices, e.g. internal electrodes}
30/872 . . . {Interconnections, e.g. connection electrodes of multilayer piezoelectric or electrostrictive devices}
30/874 . . . . {embedded within piezoelectric or electrostrictive material, e.g. via connections}
30/875 . . . {Further connection or lead arrangements, e.g. flexible wiring boards, terminal pins}
30/877 . . . {Conductive materials}
30/878 . . . . {the principal material being non-metallic, e.g. oxide or carbon based}
30/88 . . Mounts; Supports; Enclosures; Casings
30/883 . . . {Additional insulation means preventing electrical, physical or chemical damage, e.g. protective coatings}
30/886 . . . {Additional mechanical prestressing means, e.g. springs}

35/00 **Magnetostrictive devices** (integrated devices or assemblies of multiple devices H10N 39/00)

WARNING

Group H10N 35/00 is incomplete pending reclassification of documents from group H10N 30/00.

Groups H10N 30/00 and H10N 35/00 should be considered in order to perform a complete search.

35/01 . Manufacture or treatment
35/101 . {with mechanical input and electrical output, e.g. generators, sensors}
35/80 . Constructional details

WARNING

Group H10N 35/80 is incomplete pending reclassification of documents from group H10N 30/80.

Groups H10N 30/80 and H10N 35/80 should be considered in order to perform a complete search.

35/85 . . Magnetostrictive active materials

WARNING

Group H10N 35/85 is incomplete pending reclassification of documents from group H10N 30/85.

Groups H10N 30/85 and H10N 35/85 should be considered in order to perform a complete search.

39/00 **Integrated devices, or assemblies of multiple devices, comprising at least one piezoelectric, electrostrictive or magnetostrictive element covered by groups H10N 30/00 – H10N 35/00**

WARNING

Group H10N 39/00 is incomplete pending reclassification of documents from groups H01L 25/04, H01L 25/065, H01L 25/0652, H01L 25/0655, H01L 25/0657, H01L 25/16, H01L 25/162, H01L 25/165, H01L 25/167 and H01L 25/18.

All groups listed in this Warning should be considered in order to perform a complete search.

Galvanomagnetic or similar magnetic-effect devices

50/00 **Galvanomagnetic devices** (Hall-effect devices H10N 52/00; integrated devices or assemblies of multiple devices H10N 59/00)

WARNING

Group H10N 50/00 is impacted by reclassification into group H10N 50/20.

Groups H10N 50/00 and H10N 50/20 should be considered in order to perform a complete search.

50/01 . Manufacture or treatment
50/10 . Magnetoresistive devices
50/20 . Spin-polarised current-controlled devices (magnetoresistive devices H10N 50/10)

WARNING

Group H10N 50/20 is incomplete pending reclassification of documents from group H10N 50/00.

Groups H10N 50/00 and H10N 50/20 should be considered in order to perform a complete search.

50/80 . Constructional details
50/85 . . Magnetic active materials

WARNING

Group H10N 50/85 is impacted by reclassification into group H10N 52/85.

Groups H10N 50/85 and H10N 52/85 should be considered in order to perform a complete search.

52/00 **Hall-effect devices** (integrated devices or assemblies of multiple devices H10N 59/00)

52/01 . Manufacture or treatment
52/101 . {Semiconductor Hall-effect devices}
52/80 . Constructional details

52/85 . . Magnetic active materials

WARNING

Group H10N 52/85 is incomplete pending reclassification of documents from group H10N 50/85.

Groups H10N 50/85 and H10N 52/85 should be considered in order to perform a complete search.

59/00 Integrated devices, or assemblies of multiple devices, comprising at least one galvanomagnetic or Hall-effect element covered by groups H10N 50/00 - H10N 52/00 (MRAM devices H10B 61/00)

WARNING

Group H10N 59/00 is incomplete pending reclassification of documents from groups H01L 25/04, H01L 25/065, H01L 25/0652, H01L 25/0655, H01L 25/0657, H01L 25/16, H01L 25/162, H01L 25/165, H01L 25/167 and H01L 25/18.

All groups listed in this Warning should be considered in order to perform a complete search.

Group H10N 59/00 is also impacted by reclassification into group H10B 61/00.

All groups listed in this Warning should be considered in order to perform a complete search.

Superconducting devices

60/00 Superconducting devices (integrated devices or assemblies of multiple devices H10N 69/00)

60/01 . Manufacture or treatment

60/0128 . . {of composite superconductor filaments (comprising copper oxide H10N 60/0268)}

60/0156 . . {of devices comprising Nb or an alloy of Nb with one or more of the elements of group IVB, e.g. titanium, zirconium or hafnium}

60/0184 . . {of devices comprising intermetallic compounds of type A-15, e.g. Nb_3Sn}

60/0212 . . {of devices comprising molybdenum chalcogenides}

60/0241 . . {of devices comprising nitrides or carbonitrides}

60/0268 . . {of devices comprising copper oxide}

60/0296 . . . {Processes for depositing or forming copper oxide superconductor layers}

60/0324 . . . . {from a solution}

60/0352 . . . . {from a suspension or slurry, e.g. screen printing or doctor blade casting}

60/0381 . . . . {by evaporation, e.g. MBE}

60/0408 . . . . {by sputtering}

60/0436 . . . . {by chemical vapour deposition [CVD]}

60/0464 . . . . . {by metalloorganic chemical vapour deposition [MOCVD]}

60/0492 . . . . {by thermal spraying, e.g. plasma deposition}

60/0521 . . . . {by pulsed laser deposition, e.g. laser sputtering}

60/0548 . . . . {by deposition and subsequent treatment, e.g. oxidation of pre-deposited material}

60/0576 . . . . {characterised by the substrate}

60/0604 . . . . . {Monocrystalline substrates, e.g. epitaxial growth}

60/0632 . . . . . {Intermediate layers, e.g. for growth control}

60/0661 . . . {Processes performed after copper oxide formation, e.g. patterning}

60/0688 . . . . {Etching}

60/0716 . . . . {Passivating}

60/0744 . . . {Manufacture or deposition of electrodes}

60/0772 . . . {Processes including the use of non-gaseous precursors}

60/0801 . . . {Manufacture or treatment of filaments or composite wires}

60/0828 . . . {Introducing flux pinning centres}

60/0856 . . {of devices comprising metal borides, e.g. MgB_2}

60/0884 . . {Treatment of superconductor layers by irradiation, e.g. ion-beam, electron-beam, laser beam or X-rays}

60/0912 . . {of Josephson-effect devices}

60/0941 . . . {comprising high-T_c ceramic materials}

60/10 . Junction-based devices

60/11 . . {Single-electron tunnelling devices}

60/12 . . Josephson-effect devices

60/124 . . . {comprising high-T_c ceramic materials}

60/126 . . . {comprising metal borides, e.g. MgB_2}

60/128 . . {having three or more electrodes, e.g. transistor-like structures}

60/20 . Permanent superconducting devices

60/202 . . {comprising metal borides, e.g. MgB_2}

60/203 . . {comprising high-T_c ceramic materials}

60/205 . . {having three or more electrodes, e.g. transistor-like structures (H10N 60/128 takes precedence)}

60/207 . . . {Field effect devices}

60/208 . . {based on Abrikosov vortices}

60/30 . Devices switchable between superconducting and normal states

60/35 . . Cryotrons

60/355 . . . Power cryotrons

60/80 . Constructional details

60/805 . . {for Josephson-effect devices}

60/81 . . Containers; Mountings

60/815 . . . {for Josephson-effect devices}

60/82 . . Current path

60/83 . . Element shape

60/84 . . Switching means for devices switchable between superconducting and normal states

60/85 . . Superconducting active materials

60/851 . . . {Organic superconductors}

60/853 . . . . {Fullerene superconductors, e.g. soccer ball-shaped allotropes of carbon, e.g. C_{60} or C_{94}}

60/855 . . . {Ceramic superconductors}

60/857 . . . . {comprising copper oxide}

60/858 . . . . . {having multilayered structures, e.g. superlattices}

60/99 . {Alleged superconductivity}

69/00 **Integrated devices, or assemblies of multiple devices, comprising at least one superconducting element covered by group H10N 60/00**

WARNING

Group H10N 69/00 is incomplete pending reclassification of documents from groups H01L 25/04, H01L 25/065, H01L 25/0652, H01L 25/0655, H01L 25/0657, H01L 25/16, H01L 25/162, H01L 25/165, H01L 25/167 and H01L 25/18.

All groups listed in this Warning should be considered in order to perform a complete search.

Other electric solid-state devices

70/00 **Solid-state devices having no potential barriers, and specially adapted for rectifying, amplifying, oscillating or switching** (integrated devices or assemblies of multiple devices H10N 79/00)

70/011 . {Manufacture or treatment of multistable switching devices}

70/021 . . {Formation of switching materials, e.g. deposition of layers}

70/023 . . . {by chemical vapor deposition, e.g. MOCVD, ALD}

70/026 . . . {by physical vapor deposition, e.g. sputtering}

70/028 . . . {by conversion of electrode material, e.g. oxidation}

70/041 . . {Modification of switching materials after formation, e.g. doping (shaping H10N 70/061)}

70/043 . . . {by implantation}

70/046 . . . {by diffusion, e.g. photo-dissolution}

70/061 . . {Shaping switching materials}

70/063 . . . {by etching of pre-deposited switching material layers, e.g. lithography}

70/066 . . . {by filling of openings, e.g. damascene method}

70/068 . . . {by processes specially adapted for achieving sub-lithographic dimensions, e.g. using spacers}

70/10 . Solid-state travelling-wave devices

70/151 . {Charge density wave transport devices}

70/20 . Multistable switching devices, e.g. memristors

70/231 . . {based on solid-state phase change, e.g. between amorphous and crystalline phases, Ovshinsky effect}

70/235 . . . {between different crystalline phases, e.g. cubic and hexagonal}

70/24 . . {based on migration or redistribution of ionic species, e.g. anions, vacancies}

70/245 . . . {the species being metal cations, e.g. programmable metallization cells}

70/25 . . {based on bulk electronic defects, e.g. trapping of electrons}

70/253 . . {having three or more electrodes, e.g. transistor-like devices}

70/257 . . {having switching assisted by radiation or particle beam, e.g. optically controlled devices}

70/801 . {Constructional details of multistable switching devices}

70/821 . . {Device geometry}

70/823 . . . {adapted for essentially horizontal current flow, e.g. bridge type devices}

70/826 . . . {adapted for essentially vertical current flow, e.g. sandwich or pillar type devices}

70/8265 . . . . {on sidewalls of dielectric structures, e.g. mesa-shaped or cup-shaped devices}

70/828 . . . {Current flow limiting means within the switching material region, e.g. constrictions}

70/841 . . {Electrodes}

70/8413 . . . {adapted for resistive heating}

70/8416 . . . {adapted for supplying ionic species}

70/8418 . . . {adapted for focusing electric field or current, e.g. tip-shaped}

70/861 . . {Thermal details}

70/8613 . . . {Heating or cooling means other than resistive heating electrodes, e.g. heater in parallel}

70/8616 . . . {Thermal insulation means}

70/881 . . {Switching materials}

70/882 . . . {Compounds of sulfur, selenium or tellurium, e.g. chalcogenides}

70/8822 . . . . {Sulfides, e.g. CuS}

70/8825 . . . . {Selenides, e.g. GeSe}

70/8828 . . . . {Tellurides, e.g. GeSbTe}

70/883 . . . {Oxides or nitrides}

70/8833 . . . . {Binary metal oxides, e.g. TaO_x}

70/8836 . . . . {Complex metal oxides, e.g. perovskites, spinels}

70/884 . . . {based on at least one element of group IIIA, IVA or VA, e.g. elemental or compound semiconductors (compounds of sulfur, selenium or tellurium, e.g. chalcogenides H10N 70/882; oxides or nitrides H10N 70/883)}

70/8845 . . . . {Carbon or carbides}

79/00 **Integrated devices, or assemblies of multiple devices, comprising at least one solid-state element covered by group H10N 70/00** (ReRAM devices H10B 63/00; PCRAM devices H10B 63/10)

WARNING

Group H10N 79/00 is incomplete pending reclassification of documents from groups H01L 25/04, H01L 25/065, H01L 25/0652, H01L 25/0655, H01L 25/0657, H01L 25/16, H01L 25/162, H01L 25/165, H01L 25/167, H01L 25/18 and H10B 63/00.

All groups listed in this Warning should be considered in order to perform a complete search.

80/00 **Bulk negative-resistance effect devices** (integrated devices or assemblies of multiple devices H10N 89/00)

80/01 . {Manufacture or treatment}

80/10 . Gunn-effect devices

80/103 . . {controlled by electromagnetic radiation}

80/107 . . {Gunn diodes}

89/00 **Integrated devices, or assemblies of multiple devices, comprising at least one bulk negative resistance effect element covered by group H10N 80/00**

WARNING

Group H10N 89/00 is incomplete pending reclassification of documents from groups H01L 25/04, H01L 25/065, H01L 25/0652, H01L 25/0655, H01L 25/0657, H01L 25/16, H01L 25/162, H01L 25/165, H01L 25/167 and H01L 25/18.

All groups listed in this Warning should be considered in order to perform a complete search.

89/02 . {Gunn-effect integrated devices}

97/00 **Electric solid-state thin-film or thick-film devices, not otherwise provided for**

99/00 **Subject matter not provided for in other groups of this subclass**

99/03 . {Devices using Mott metal-insulator transition, e.g. field-effect transistor-like devices}

99/05 . {Devices based on quantum mechanical effects, e.g. quantum interference devices or metal single-electron transistors}