SECTION H — ELECTRICITY

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

H10B ELECTRONIC MEMORY DEVICES [2023.01]

Note(s) [2024.01]

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.

Subclass index

Volatile memory devices [2023.01]

10/00 Static random access memory [SRAM] devices [2023.01]

10/10 • SRAM devices comprising bipolar components **[2023.01]**

12/00 Dynamic random access memory [DRAM] devices [2023.01]

12/10 • DRAM devices comprising bipolar components **[2023.01]**

Non-volatile memory devices [2023.01]

20/00 Read-only memory [ROM] devices [2023.01]

20/10 • ROM devices comprising bipolar components **[2023.01]**

20/20 • Programmable ROM [PROM] devices comprising field-effect components (H10B 20/10 takes precedence) **[2023.01]**

20/25 • • One-time programmable ROM [OTPROM] devices, e.g. using electrically-fusible links **[2023.01]**

41/00 Electrically erasable-and-programmable ROM [EEPROM] devices comprising floating gates [2023.01]

41/10 • characterised by the top-view layout **[2023.01]**

41/20 • characterised by three-dimensional arrangements, e.g. with cells on different height levels **[2023.01]**

41/23 • • with source and drain on different levels, e.g. with sloping channels **[2023.01]**

41/27 • • • the channels comprising vertical portions, e.g. U-shaped channels **[2023.01]**

41/30 • characterised by the memory core region **[2023.01]**

41/35 • • with a cell select transistor, e.g. NAND **[2023.01]**

41/40 • characterised by the peripheral circuit region **[2023.01]**

41/41 • • of a memory region comprising a cell select transistor, e.g. NAND **[2023.01]**

41/42 • • Simultaneous manufacture of periphery and memory cells **[2023.01]**

41/43 • • • comprising only one type of peripheral transistor **[2023.01]**

41/44 • • • • with a control gate layer also being used as part of the peripheral transistor **[2023.01]**

41/46 • • • • with an inter-gate dielectric layer also being used as part of the peripheral transistor **[2023.01]**

41/47 • • • • with a floating-gate layer also being used as part of the peripheral transistor **[2023.01]**

41/48 • • • • with a tunnel dielectric layer also being used as part of the peripheral transistor **[2023.01]**

41/49 • • • comprising different types of peripheral transistor **[2023.01]**

41/50 • characterised by the boundary region between the core region and the peripheral circuit region **[2023.01]**
41/60 • the control gate being a doped region, e.g. single-poly memory cell **[2023.01]**
41/70 • the floating gate being an electrode shared by two or more components **[2023.01]**

43/00 EEPROM devices comprising charge-trapping gate insulators [2023.01]
43/10 • characterised by the top-view layout **[2023.01]**
43/20 • characterised by three-dimensional arrangements, e.g. with cells on different height levels **[2023.01]**
43/23 • • with source and drain on different levels, e.g. with sloping channels **[2023.01]**
43/27 • • • the channels comprising vertical portions, e.g. U-shaped channels **[2023.01]**
43/30 • characterised by the memory core region **[2023.01]**
43/35 • • with cell select transistors, e.g. NAND **[2023.01]**
43/40 • characterised by the peripheral circuit region **[2023.01]**
43/50 • characterised by the boundary region between the core and peripheral circuit regions **[2023.01]**

51/00 Ferroelectric RAM [FeRAM] devices comprising ferroelectric memory transistors [2023.01]
51/10 • characterised by the top-view layout **[2023.01]**
51/20 • characterised by the three-dimensional arrangements, e.g. with cells on different height levels **[2023.01]**
51/30 • characterised by the memory core region **[2023.01]**
51/40 • characterised by the peripheral circuit region **[2023.01]**
51/50 • characterised by the boundary region between the core and peripheral circuit regions **[2023.01]**

53/00 Ferroelectric RAM [FeRAM] devices comprising ferroelectric memory capacitors [2023.01]
53/10 • characterised by the top-view layout **[2023.01]**
53/20 • characterised by the three-dimensional arrangements, e.g. with cells on different height levels **[2023.01]**
53/30 • characterised by the memory core region **[2023.01]**
53/40 • characterised by the peripheral circuit region **[2023.01]**
53/50 • characterised by the boundary region between the core and peripheral circuit regions **[2023.01]**

61/00 Magnetic memory devices, e.g. magnetoresistive RAM [MRAM] devices [2023.01]

63/00 Resistance change memory devices, e.g. resistive RAM [ReRAM] devices [2023.01]
63/10 • Phase change RAM [PCRAM, PRAM] devices **[2023.01]**

69/00 Erasable-and-programmable ROM [EPROM] devices not provided for in groups H10B 41/00-H10B 63/00, e.g. ultraviolet erasable-and-programmable ROM [UVEPROM] devices [2023.01]

80/00 Assemblies of multiple devices comprising at least one memory device covered by this subclass [2023.01]

99/00 Subject matter not provided for in other groups of this subclass [2023.01]

H10D INORGANIC ELECTRIC SEMICONDUCTOR DEVICES [2025.01]

Note(s) [2025.01]

1. *This subclass covers electric semiconductor devices having inorganic semiconductor bodies. This includes the following kind of devices:*
   - *inorganic semiconductor devices specially adapted for rectifying, amplifying, oscillating or switching, e.g. transistors or diodes;*
   - *individual inorganic resistors or capacitors having potential barriers;*
   - *individual resistors, capacitors or inductors having no potential barriers, and specially adapted for integration with other semiconductor components;*
   - *semiconductor bodies, or regions thereof, of devices covered by this subclass;*
   - *electrodes of devices covered by this subclass;*
   - *integrated devices, e.g. CMOS integrated devices;*
   - *processes or apparatus specially adapted for the manufacture or treatment of such devices.*
2. *This subclass does not cover:*
   - *electronic memory devices, which are covered by subclass H10B;*
   - *semiconductor devices sensitive to infrared radiation, light, electromagnetic radiation of shorter wavelength or corpuscular radiation, which are covered by subclass H10F;*
   - *light-emitting semiconductor devices having at least one potential barrier, which are covered by subclass H10H;*
   - *thermoelectric, thermomagnetic, piezoelectric, electrostrictive, magnetostrictive, magnetic-effect, superconducting or other electric solid-state devices, which are covered by subclass H10N;*
   - *constructional details other than semiconductor bodies or electrodes, which are covered by group H01L 23/00.*
3. *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.*

Subclass index

Individual devices [2025.01]

1/00 ***Resistors, capacitors or inductors [2025.01]***

Note(s) [2025.01]

This group covers:
- *individual inorganic resistors or capacitors having potential barriers;*
- *individual resistors, capacitors or inductors having no potential barriers, and specially adapted for integration with other semiconductor components.*

1/20 • *Inductors* ***[2025.01]***
1/40 • *Resistors* ***[2025.01]***
1/43 • • *Resistors having PN junctions* ***[2025.01]***
1/47 • • *Resistors having no potential barriers* ***[2025.01]***
1/60 • *Capacitors* ***[2025.01]***
1/62 • • *Capacitors having potential barriers* ***[2025.01]***
1/64 • • • *Variable-capacitance diodes, e.g. varactors* ***[2025.01]***
1/66 • • • *Conductor-insulator-semiconductor capacitors, e.g. MOS capacitors* ***[2025.01]***
1/68 • • *Capacitors having no potential barriers* ***[2025.01]***

8/00 ***Diodes*** *(variable-capacitance diodes H10D 1/64; gated diodes H10D 12/00)* ***[2025.01]***

Note(s) [2025.01]

In this group, when the manufacture or treatment of a device is determined to be novel and non-obvious, the device itself is also classified.

8/01 • *Manufacture or treatment* ***[2025.01]***
8/20 • *Breakdown diodes, e.g. avalanche diodes* ***[2025.01]***
8/25 • • *Zener diodes* ***[2025.01]***
8/30 • *Point-contact diodes* ***[2025.01]***
8/40 • *Transit-time diodes, e.g. IMPATT or TRAPATT diodes* ***[2025.01]***
8/50 • *PIN diodes* ***[2025.01]***
8/60 • *Schottky-barrier diodes* ***[2025.01]***
8/70 • *Tunnel-effect diodes* ***[2025.01]***
8/75 • • *Tunnel-effect PN diodes, e.g. Esaki diodes* ***[2025.01]***
8/80 • *PNPN diodes, e.g. Shockley diodes or break-over diodes* ***[2025.01]***

10/00 ***Bipolar junction transistors [BJT] [2025.01]***

Note(s) [2025.01]

In this group, when the manufacture or treatment of a device is determined to be novel and non-obvious, the device itself is also classified.

10/01 • *Manufacture or treatment* ***[2025.01]***
10/40 • *Vertical BJTs* ***[2025.01]***
10/60 • *Lateral BJTs* ***[2025.01]***
10/80 • *Heterojunction BJTs* ***[2025.01]***

12/00 ***Bipolar devices controlled by the field effect, e.g. insulated-gate bipolar transistors [IGBT] [2025.01]***

Note(s) [2025.01]

In this group, when the manufacture or treatment of a device is determined to be novel and non-obvious, the device itself is also classified.

12/01 • *Manufacture or treatment* ***[2025.01]***

18/00 ***Thyristors [2025.01]***

Note(s) [2025.01]

In this group, when the manufacture or treatment of a device is determined to be novel and non-obvious, the device itself is also classified.

18/01 • *Manufacture or treatment* ***[2025.01]***
18/40 • *with turn-on by field effect* ***[2025.01]***
18/60 • *Gate-turn-off devices* ***[2025.01]***
18/65 • • *with turn-off by field effect* ***[2025.01]***
18/80 • *Bidirectional devices, e.g. triacs* ***[2025.01]***

30/00 ***Field-effect transistors [FET]*** *(insulated-gate bipolar transistors H10D 12/00)* ***[2025.01]***

Note(s) [2025.01]

In this group, when the manufacture or treatment of a device is determined to be novel and non-obvious, the device itself is also classified.

30/01 • *Manufacture or treatment* ***[2025.01]***
30/40 • *FETs having zero-dimensional [0D], one-dimensional [1D] or two-dimensional [2D] charge carrier gas channels* ***[2025.01]***
30/43 • • *having 1D charge carrier gas channels, e.g. quantum wire FETs or transistors having 1D quantum-confined channels* ***[2025.01]***
30/47 • • *having 2D charge carrier gas channels, e.g. nanoribbon FETs or high electron mobility transistors [HEMT]* ***[2025.01]***
30/60 • *Insulated-gate field-effect transistors [IGFET] (H10D 30/40 takes precedence)* ***[2025.01]***
30/62 • • *Fin field-effect transistors [FinFET]* ***[2025.01]***
30/63 • • *Vertical IGFETs (H10D 30/66 takes precedence)* ***[2025.01]***
30/64 • • *Double-diffused metal-oxide semiconductor [DMOS] FETs* ***[2025.01]***
30/65 • • • *Lateral DMOS [LDMOS] FETs* ***[2025.01]***
30/66 • • • *Vertical DMOS [VDMOS] FETs* ***[2025.01]***
30/67 • • *Thin-film transistors [TFT]* ***[2025.01]***

30/68 • • *Floating-gate IGFETs* ***[2025.01]***

30/69 • • *IGFETs having charge trapping gate insulators, e.g. MNOS transistors* ***[2025.01]***

30/80 • *FETs having rectifying junction gate electrodes (H10D 30/40 takes precedence)* ***[2025.01]***

30/83 • • *FETs having PN junction gate electrodes* ***[2025.01]***

30/87 • • *FETs having Schottky gate electrodes, e.g. metal-semiconductor FETs [MESFET]* ***[2025.01]***

44/00 Charge transfer devices [2025.01]

Note(s) [2025.01]

In this group, when the manufacture or treatment of a device is determined to be novel and non-obvious, the device itself is also classified.

44/01 • *Manufacture or treatment* ***[2025.01]***

44/40 • *Charge-coupled devices [CCD]* ***[2025.01]***

44/45 • • *having field effect produced by insulated gate electrodes* ***[2025.01]***

48/00 Individual devices not covered by groups H10D 1/00-H10D 44/00 [2025.01]

Note(s) [2025.01]

In this group, when the manufacture or treatment of a device is determined to be novel and non-obvious, the device itself is also classified.

48/01 • *Manufacture or treatment* ***[2025.01]***

48/04 • • *of devices having bodies comprising selenium or tellurium in uncombined form* ***[2025.01]***

48/042 • • • *Preparation of foundation plates* ***[2025.01]***

48/043 • • • *Preliminary treatment of the selenium or tellurium, its application to foundation plates or the subsequent treatment of the combination* ***[2025.01]***

48/044 • • • • *Conversion of the selenium or tellurium to the conductive state* ***[2025.01]***

48/045 • • • • *Treatment of the surface of the selenium or tellurium layer after having been made conductive* ***[2025.01]***

48/046 • • • • *Provision of discrete insulating layers* ***[2025.01]***

48/047 • • • *Application of an electrode to the exposed surface of the selenium or tellurium after the selenium or tellurium has been applied to foundation plates* ***[2025.01]***

48/048 • • • *Treatment of the complete device, e.g. by electroforming to form a barrier* ***[2025.01]***

48/049 • • • • *Ageing* ***[2025.01]***

48/07 • • *of devices having bodies comprising cuprous oxide [Cu_2O] or cuprous iodide [CuI]* ***[2025.01]***

48/30 • *Devices controlled by electric currents or voltages* ***[2025.01]***

48/32 • • *Devices controlled 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* ***[2025.01]***

48/34 • • • *Bipolar devices* ***[2025.01]***

48/36 • • • *Unipolar devices* ***[2025.01]***

48/38 • • *Devices controlled only by variation of the electric current supplied, or only the electric potential applied, to one or more of the electrodes carrying the current to be rectified, amplified, oscillated or switched* ***[2025.01]***

48/40 • *Devices controlled by magnetic fields* ***[2025.01]***

48/50 • *Devices controlled by mechanical forces, e.g. pressure* ***[2025.01]***

Constructional details [2025.01]

62/00 Semiconductor bodies, or regions thereof, of devices having potential barriers [2025.01]

62/10 • *Shapes, relative sizes or dispositions of the regions of the semiconductor bodies; Shapes of the semiconductor bodies* ***[2025.01]***

62/13 • • *Semiconductor regions connected to electrodes carrying current to be rectified, amplified or switched, e.g. source or drain regions* ***[2025.01]***

Note(s) [2025.01]

This group covers only semiconductor regions for devices that comprise three or more electrodes.

62/17 • • *Semiconductor regions connected to electrodes not carrying current to be rectified, amplified or switched, e.g. channel regions* ***[2025.01]***

62/40 • *Crystalline structures* ***[2025.01]***

62/50 • *Physical imperfections* ***[2025.01]***

62/53 • • *the imperfections being within the semiconductor body* ***[2025.01]***

62/57 • • *the imperfections being on the surface of the semiconductor body, e.g. the body having a roughened surface* ***[2025.01]***

62/60 • *Impurity distributions or concentrations* ***[2025.01]***

62/80 • *characterised by the materials* ***[2025.01]***

Note(s) [2025.01]

1. *When classifying in this group, constituents of a material are considered irrespective of any dopants or other impurities.*
2. *In this group:*
   - *groups H10D 62/81-H10D 62/815, covering quantum or superlattice structures, take precedence over groups H10D 62/82-H10D 62/826, covering heterojunctions;*
   - *groups H10D 62/82-H10D 62/826, covering heterojunctions, take precedence over groups H10D 62/83-H10D 62/864, covering other materials.*

62/81 • • *of structures exhibiting quantum-confinement effects, e.g. single quantum wells; of structures having periodic or quasi-periodic potential variation* ***[2025.01]***

62/815 • • • *of structures having periodic or quasi-periodic potential variation, e.g. superlattices or multiple quantum wells [MQW]* ***[2025.01]***

62/82 • • *Heterojunctions* ***[2025.01]***

62/822 • • • *comprising only Group IV materials heterojunctions, e.g. Si/Ge heterojunctions* ***[2025.01]***

62/824 • • • *comprising only Group III-V materials heterojunctions, e.g. GaN/AlGaN heterojunctions* ***[2025.01]***

62/826 • • • *comprising only Group II-VI materials heterojunctions, e.g. CdTe/HgTe heterojunctions* ***[2025.01]***

62/83 • • *being Group IV materials, e.g. B-doped Si or undoped Ge* ***[2025.01]***

62/832 • • • *being Group IV materials comprising two or more elements, e.g. SiGe* ***[2025.01]***

62/834 • • • *further characterised by the dopants* ***[2025.01]***

62/84 • • *being selenium or tellurium only* ***[2025.01]***

Note(s) [2025.01]

This group does not cover chemical compounds of selenium or of tellurium.

62/85 • • *being Group III-V materials, e.g. GaAs* ***[2025.01]***

62/852 • • • *being Group III-V materials comprising three or more elements, e.g. AlGaN or InAsSbP* ***[2025.01]***

62/854 • • • *further characterised by the dopants* ***[2025.01]***

62/86 • • *being Group II-VI materials, e.g. ZnO* ***[2025.01]***

62/862 • • • *being Group II-VI materials comprising three or more elements, e.g. CdZnTe* ***[2025.01]***

62/864 • • • *further characterised by the dopants* ***[2025.01]***

64/00 Electrodes of devices having potential barriers [2025.01]

64/01 • *Manufacture or treatment* ***[2025.01]***

64/20 • *Electrodes characterised by their shapes, relative sizes or dispositions* ***[2025.01]***

64/23 • • *Electrodes carrying the current to be rectified, amplified, oscillated or switched, e.g. sources, drains, anodes or cathodes* ***[2025.01]***

64/27 • • *Electrodes not carrying the current to be rectified, amplified, oscillated or switched, e.g. gates* ***[2025.01]***

64/60 • *Electrodes characterised by their materials* ***[2025.01]***

64/62 • • *Electrodes ohmically coupled to a semiconductor* ***[2025.01]***

64/64 • • *Electrodes comprising a Schottky barrier to a semiconductor* ***[2025.01]***

64/66 • • *Electrodes having a conductor capacitively coupled to a semiconductor by an insulator, e.g. MIS electrodes* ***[2025.01]***

64/68 • • • *characterised by the insulator, e.g. by the gate insulator* ***[2025.01]***

Integrated devices; Assemblies of multiple devices [2025.01]

80/00 Assemblies of multiple devices comprising at least one device covered by this subclass [2025.01]

80/20 • *the at least one device being covered by groups H10D 1/00-H10D 48/00, e.g. assemblies comprising capacitors, power FETs or Schottky diodes* ***[2025.01]***

80/30 • *the at least one device being covered by groups H10D 84/00-H10D 86/00, e.g. assemblies comprising integrated circuit processor chips* ***[2025.01]***

84/00 Integrated devices formed in or on semiconductor substrates that comprise only semiconducting layers, e.g. on Si wafers or on GaAs-on-Si wafers [2025.01]

Note(s) [2025.01]

In this group, when the manufacture or treatment of a device is determined to be novel and non-obvious, the device itself is also classified.

84/01 • *Manufacture or treatment* ***[2025.01]***

84/02 • • *characterised by using material-based technologies* ***[2025.01]***

84/03 • • • *using Group IV technology, e.g. silicon technology or silicon-carbide [SiC] technology* ***[2025.01]***

84/05 • • • *using Group III-V technology* ***[2025.01]***

84/07 • • • *using Group II-VI technology* ***[2025.01]***

84/08 • • • *using combinations of technologies, e.g. using both Si and SiC technologies or using both Si and Group III-V technologies* ***[2025.01]***

84/40 • *characterised by the integration of at least one component covered by groups H10D 12/00 or H10D 30/00 with at least one component covered by groups H10D 10/00 or H10D 18/00, e.g. integration of IGFETs with BJTs* ***[2025.01]***

84/60 • *characterised by the integration of at least one component covered by groups H10D 10/00 or H10D 18/00, e.g. integration of BJTs (H10D 84/40 takes precedence)* ***[2025.01]***

84/63 • • *Combinations of vertical and lateral BJTs* ***[2025.01]***

84/65 • • *Integrated injection logic* ***[2025.01]***

84/67 • • *Complementary BJTs* ***[2025.01]***

84/80 • *characterised by the integration of at least one component covered by groups H10D 12/00 or H10D 30/00, e.g. integration of IGFETs (H10D 84/40 takes precedence)* ***[2025.01]***

84/82 • • *of only field-effect components* ***[2025.01]***

84/83 • • • *of only insulated-gate FETs [IGFET]* ***[2025.01]***

84/84 • • • • *Combinations of enhancement-mode IGFETs and depletion-mode IGFETs* ***[2025.01]***

84/85 • • • • *Complementary IGFETs, e.g. CMOS* ***[2025.01]***

84/86 • • *of Schottky-barrier gate FETs* ***[2025.01]***

84/87 • • *of PN-junction gate FETs* ***[2025.01]***

84/90 • *Masterslice integrated circuits* ***[2025.01]***

86/00 Integrated devices formed in or on insulating or conducting substrates, e.g. formed in silicon-on-insulator [SOI] substrates or on stainless steel or glass substrates [2025.01]

Note(s) [2025.01]

In this group, when the manufacture or treatment of a device is determined to be novel and non-obvious, the device itself is also classified.

86/01 • *Manufacture or treatment* ***[2025.01]***

86/03 • • *wherein the substrate comprises sapphire, e.g. silicon-on-sapphire [SOS]* ***[2025.01]***

86/40 • *characterised by multiple TFTs* ***[2025.01]***

86/60 • • *wherein the TFTs are in active matrices* ***[2025.01]***

86/80 • *characterised by multiple passive components, e.g. resistors, capacitors or inductors* ***[2025.01]***

86/85 • • *characterised by only passive components* ***[2025.01]***

87/00 Integrated devices comprising both bulk components and either SOI or SOS components on the same substrate [2025.01]

88/00 Three-dimensional [3D] integrated devices [2025.01]

89/00 Aspects of integrated devices not covered by groups H10D 84/00-H10D 88/00 [2025.01]

89/10 • *Integrated device layouts* ***[2025.01]***

89/60 • *Integrated devices comprising arrangements for electrical or thermal protection, e.g. protection circuits against electrostatic discharge [ESD]* ***[2025.01]***

99/00 Subject matter not provided for in other groups of this subclass [2025.01]

H10F INORGANIC SEMICONDUCTOR DEVICES SENSITIVE TO INFRARED RADIATION, LIGHT, ELECTROMAGNETIC RADIATION OF SHORTER WAVELENGTH OR CORPUSCULAR RADIATION [2025.01]

Note(s) [2025.01]

1. *This subclass covers inorganic radiation-sensitive semiconductor devices insofar as these devices are specially adapted for:*
   - *the conversion of the radiation energy into electrical energy; or*
   - *the control of electrical energy by such radiation.*
2. *In this subclass, "infrared radiation" includes wavelengths between about 700 nm and about 1 mm.*
3. *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.*

Subclass index

Photovoltaics [2025.01]

10/00 ***Individual photovoltaic cells, e.g. solar cells*** *(electrolytic light-sensitive devices, e.g. dye-sensitised solar cells, H01G 9/20)* ***[2025.01]***

10/10 • *having potential barriers* ***[2025.01]***

10/11 • • *Photovoltaic cells having point contact potential barriers (H10F 10/18 takes precedence)* ***[2025.01]***

10/12 • • *Photovoltaic cells having only metal-insulator-semiconductor [MIS] potential barriers* ***[2025.01]***

10/13 • • *Photovoltaic cells having absorbing layers comprising graded bandgaps* ***[2025.01]***

10/14 • • *Photovoltaic cells having only PN homojunction potential barriers* ***[2025.01]***

10/142 • • • *comprising multiple PN homojunctions, e.g. tandem cells* ***[2025.01]***

10/144 • • • *comprising only Group III-V materials, e.g. GaAs,AlGaAs, or InP photovoltaic cells* ***[2025.01]***

10/16 • • *Photovoltaic cells having only PN heterojunction potential barriers* ***[2025.01]***

10/161 • • • *comprising multiple PN heterojunctions, e.g. tandem cells* ***[2025.01]***

10/162 • • • *comprising only Group II-VI materials, e.g. CdS/CdTe photovoltaic cells* ***[2025.01]***

10/163 • • • *comprising only Group III-V materials, e.g. GaAs/AlGaAs or InP/GaInAs photovoltaic cells* ***[2025.01]***

10/164 • • • *comprising heterojunctions with Group IV materials, e.g. ITO/Si or GaAs/SiGe photovoltaic cells* ***[2025.01]***

10/165 • • • • *the heterojunctions being Group IV-IV heterojunctions, e.g. Si/Ge, SiGe/Si or Si/SiC photovoltaic cells* ***[2025.01]***

10/166 • • • • • *the Group IV-IV heterojunctions being heterojunctions of crystalline and amorphous materials, e.g. silicon heterojunction [SHJ] photovoltaic cells* ***[2025.01]***

10/167 • • • *comprising Group I-III-VI materials, e.g. CdS/CuInSe₂ [CIS] heterojunction photovoltaic cells* ***[2025.01]***

10/17 • • *Photovoltaic cells having only PIN junction potential barriers* ***[2025.01]***

10/172 • • • *comprising multiple PIN junctions, e.g. tandem cells* ***[2025.01]***

10/174 • • • *comprising monocrystalline or polycrystalline materials* ***[2025.01]***

10/18 • • *Photovoltaic cells having only Schottky potential barriers* ***[2025.01]***

10/19 • • *Photovoltaic cells having multiple potential barriers of different types, e.g. tandem cells having both PN and PIN junctions* ***[2025.01]***

19/00 ***Integrated devices, or assemblies of multiple devices, comprising at least one photovoltaic cell covered by group H10F 10/00, e.g. photovoltaic modules [2025.01]***

19/10 • *comprising photovoltaic cells in arrays in a single semiconductor substrate, the photovoltaic cells having vertical junctions or V-groove junctions* ***[2025.01]***

19/20 • *comprising photovoltaic cells in arrays in or on a single semiconductor substrate, the photovoltaic cells having planar junctions (having multiple thin-film photovoltaic cells deposited on the same substrate H10F 19/31)* ***[2025.01]***

19/30 • *comprising thin-film photovoltaic cells* ***[2025.01]***

19/31 • • *having multiple laterally adjacent thin-film photovoltaic cells deposited on the same substrate* ***[2025.01]***

19/33 • • • *Patterning processes to connect the photovoltaic cells, e.g. laser cutting of conductive or active layers* ***[2025.01]***

19/35 • • • *Structures for the connecting of adjacent photovoltaic cells, e.g. interconnections or insulating spacers* ***[2025.01]***

19/37 • • • *comprising means for obtaining partial light transmission through the integrated devices, or the assemblies of multiple devices, e.g. partially transparent thin-film photovoltaic modules for windows* ***[2025.01]***

19/40 • *comprising photovoltaic cells in a mechanically stacked configuration* ***[2025.01]***

19/50 • *Integrated devices comprising at least one photovoltaic cell and other types of semiconductor or solid-state components (H10F 19/75 takes precedence)* ***[2025.01]***

19/70 • *comprising bypass diodes (bypass diodes in a junction box H02S 40/34)* ***[2025.01]***

19/75 • • *the bypass diodes being integrated or directly associated with the photovoltaic cells, e.g. formed in or on the same substrate* ***[2025.01]***

19/80 • *Encapsulations or containers for integrated devices, or assemblies of multiple devices, having photovoltaic cells* ***[2025.01]***

19/85 • • *Protective back sheets* ***[2025.01]***

19/90 • *Structures for connecting between photovoltaic cells, e.g. interconnections or insulating spacers (between thin-film photovoltaic cells on a single substrate H10F 19/35)* ***[2025.01]***

Radiation-controlled devices [2025.01]

30/00 ***Individual radiation-sensitive semiconductor devices in which radiation controls the flow of current through the devices, e.g. photodetectors [2025.01]***

30/10 • *the devices being sensitive to infrared radiation, visible or ultraviolet radiation, and having no potential barriers, e.g. photoresistors* ***[2025.01]***

30/20 • *the devices having potential barriers, e.g. phototransistors* ***[2025.01]***

30/21 • • *the devices being sensitive to infrared, visible or ultraviolet radiation* ***[2025.01]***

30/22 • • • *the devices having only one potential barrier, e.g. photodiodes* ***[2025.01]***

30/221 • • • • *the potential barrier being a PN homojunction* ***[2025.01]***

30/222 • • • • *the potential barrier being a PN heterojunction* ***[2025.01]***

30/223 • • • • *the potential barrier being a PIN barrier* ***[2025.01]***

30/225 • • • • *the potential barrier working in avalanche mode, e.g. avalanche photodiodes* ***[2025.01]***

30/227 • • • • *the potential barrier being a Schottky barrier* ***[2025.01]***

30/24 • • • *the devices having only two potential barriers, e.g. bipolar phototransistors* ***[2025.01]***

30/26 • • • *the devices having three or more potential barriers, e.g. photothyristors* ***[2025.01]***

30/28 • • • *the devices being characterised by field-effect operation, e.g. junction field-effect phototransistors* ***[2025.01]***

30/282 • • • • *Insulated-gate field-effect transistors [IGFET], e.g. MISFET [metal-insulator-semiconductor field-effect transistor] phototransistors* ***[2025.01]***

30/29 • • *the devices being sensitive to radiation having very short wavelengths, e.g. X-rays, gamma-rays or corpuscular radiation* ***[2025.01]***

30/292 • • • *Bulk-effect radiation detectors, e.g. Ge-Li compensated PIN gamma-ray detectors* ***[2025.01]***

30/295 • • • *Surface barrier or shallow PN junction radiation detectors, e.g. surface barrier alpha-particle detectors* ***[2025.01]***

30/298 • • • *the devices being characterised by field-effect operation, e.g. MIS type detectors* ***[2025.01]***

39/00 ***Integrated devices, or assemblies of multiple devices, comprising at least one element covered by group H10F 30/00, e.g. radiation detectors comprising photodiode arrays [2025.01]***

39/10 • *Integrated devices* ***[2025.01]***

39/12 • • *Image sensors* ***[2025.01]***

39/15 • • • *Charge-coupled device [CCD] image sensors* ***[2025.01]***

39/18 • • • *Complementary metal-oxide-semiconductor [CMOS] image sensors; Photodiode array image sensors* ***[2025.01]***

39/90 • *Assemblies of multiple devices* ***[2025.01]***

39/95 • • *comprising at least one integrated device covered by group H10F 39/10, e.g. comprising integrated image sensors* ***[2025.01]***

Other devices [2025.01]

55/00 ***Radiation-sensitive semiconductor devices covered by groups H10F 10/00, H10F 19/00 or H10F 30/00 being structurally associated with electric light sources and electrically or optically coupled thereto [2025.01]***

55/10 • *wherein the radiation-sensitive semiconductor devices control the electric light source, e.g. image converters, image amplifiers or image storage devices* ***[2025.01]***

55/15 • • *wherein the radiation-sensitive devices and the electric light source are all semiconductor devices* ***[2025.01]***

55/155 • • • *formed in, or on, a common substrate* ***[2025.01]***

55/20 • *wherein the electric light source controls the radiation-sensitive semiconductor devices, e.g. optocouplers* ***[2025.01]***

55/25 • • *wherein the radiation-sensitive devices and the electric light source are all semiconductor devices* ***[2025.01]***

55/255 • • • *formed in, or on, a common substrate* ***[2025.01]***

Manufacture or treatment; Constructional details [2025.01]

71/00 ***Manufacture or treatment of devices covered by this subclass*** *(patterning processes to connect thin photovoltaic cells in integrated devices, or assemblies of multiple devices, having photovoltaic cells H10F 19/33; manufacture or treatment of encapsulations or containers for integrated devices, or assemblies of multiple devices, having photovoltaic cells H10F 19/80; manufacture or treatment of integrated devices, or assemblies of multiple devices, comprising at least one element in which radiation controls the flow of current H10F 39/00)* ***[2025.01]***

71/10 • *the devices comprising amorphous semiconductor material* ***[2025.01]***

77/00 ***Constructional details of devices covered by this subclass*** *(constructional details of integrated devices, or assemblies of multiple devices, comprising at least one element in which radiation controls the flow of current H10F 39/00)* ***[2025.01]***

Note(s) [2025.01]

When classifying in this group, the type of device itself, when it is determined to be novel and non-obvious, should be classified in groups H10F 10/00, H10F 19/00, H10F 30/00 or H10F 55/00.

77/10 • *Semiconductor bodies* ***[2025.01]***
77/12 • • *Active materials* ***[2025.01]***

Note(s) [2025.01]

When classifying in this group, constituents of a material are considered irrespective of any dopants or other impurities.

77/121 • • • *comprising only selenium or only tellurium* ***[2025.01]***
77/122 • • • *comprising only Group IV materials* ***[2025.01]***
77/1223 • • • • *characterised by the dopants* ***[2025.01]***
77/1226 • • • • *comprising multiple Group IV elements, e.g. SiC* ***[2025.01]***
77/123 • • • *comprising only Group II-VI materials, e.g. CdS, ZnS or HgCdTe* ***[2025.01]***
77/124 • • • *comprising only Group III-V materials, e.g. GaAs* ***[2025.01]***
77/14 • • *Shape of semiconductor bodies; Shapes, relative sizes or dispositions of semiconductor regions within semiconductor bodies* ***[2025.01]***
77/16 • • *Material structures, e.g. crystalline structures, film structures or crystal plane orientations* ***[2025.01]***
77/162 • • • *Non-monocrystalline materials, e.g. semiconductor particles embedded in insulating materials (H10F 77/169 takes precedence)* ***[2025.01]***
77/164 • • • • *Polycrystalline semiconductors* ***[2025.01]***
77/166 • • • • *Amorphous semiconductors* ***[2025.01]***
77/169 • • • *Thin semiconductor films on metallic or insulating substrates* ***[2025.01]***
77/20 • *Electrodes* ***[2025.01]***
77/30 • *Coatings (arrangements for preventing damage to photovoltaic cells caused by corpuscular radiation H10F 77/80)* ***[2025.01]***
77/40 • *Optical elements or arrangements (surface textures H10F 77/70)* ***[2025.01]***
77/42 • • *directly associated or integrated with photovoltaic cells, e.g. light-reflecting means or light-concentrating means* ***[2025.01]***
77/45 • • • *Wavelength conversion means, e.g. by using luminescent material, fluorescent concentrators or up-conversion arrangements* ***[2025.01]***
77/48 • • • *Back surface reflectors [BSR]* ***[2025.01]***
77/50 • *Encapsulations or containers (for photovoltaic modules H10F 19/80)* ***[2025.01]***
77/60 • *Arrangements for cooling, heating, ventilating or compensating for temperature fluctuations* ***[2025.01]***
77/63 • • *Arrangements for cooling directly associated or integrated with photovoltaic cells, e.g. heat sinks directly associated with the photovoltaic cells or integrated Peltier elements for active cooling* ***[2025.01]***
77/67 • • • *including means to utilise heat energy directly associated with the photovoltaic cells, e.g. integrated Seebeck elements* ***[2025.01]***
77/70 • *Surface textures, e.g. pyramid structures* ***[2025.01]***
77/80 • *Arrangements for preventing damage to photovoltaic cells caused by corpuscular radiation, e.g. for space applications* ***[2025.01]***
77/90 • *Energy storage means directly associated or integrated with photovoltaic cells, e.g. capacitors integrated with photovoltaic cells* ***[2025.01]***

99/00 ***Subject matter not provided for in other groups of this subclass [2025.01]***

H10H INORGANIC LIGHT-EMITTING SEMICONDUCTOR DEVICES HAVING POTENTIAL BARRIERS [2025.01]

Note(s) [2025.01]

1. *This subclass covers inorganic light-emitting semiconductor devices that emit visible, infrared [IR] or ultraviolet [UV] light. This includes light-emitting diodes [LED] and superluminescent diodes [SLD].*
2. *This subclass does not cover semiconductor lasers, which are covered by group H01S 5/00.*
3. *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.*

20/00 ***Individual inorganic light-emitting semiconductor devices having potential barriers, e.g. light-emitting diodes [LED] [2025.01]***
20/01 • *Manufacture or treatment* ***[2025.01]***
20/80 • *Constructional details* ***[2025.01]***
20/81 • • *Bodies* ***[2025.01]***
20/811 • • • *having quantum effect structures or superlattices, e.g. tunnel junctions* ***[2025.01]***
20/812 • • • • *within the light-emitting regions, e.g. having quantum confinement structures* ***[2025.01]***
20/813 • • • *having a plurality of light-emitting regions, e.g. multi-junction LEDs or light-emitting devices having photoluminescent regions within the bodies* ***[2025.01]***
20/814 • • • *having reflecting means, e.g. semiconductor Bragg reflectors* ***[2025.01]***
20/815 • • • *having stress relaxation structures, e.g. buffer layers* ***[2025.01]***
20/816 • • • *having carrier transport control structures, e.g. highly-doped semiconductor layers or current-blocking structures* ***[2025.01]***
20/817 • • • *characterised by the crystal structures or orientations, e.g. polycrystalline, amorphous or porous* ***[2025.01]***
20/818 • • • • *within the light-emitting regions* ***[2025.01]***

Note(s) [2025.01]

When classifying in this group, classification is also made in group H10H 20/822 in order to identify the chemical composition of the light-emitting region.

20/819 • • • *characterised by their shape, e.g. curved or truncated substrates* ***[2025.01]***

20/82 • • • • *Roughened surfaces, e.g. at the interface between epitaxial layers* ***[2025.01]***

20/821 • • • • *of the light-emitting regions, e.g. non-planar junctions* ***[2025.01]***

20/822 • • • *Materials of the light-emitting regions* ***[2025.01]***

Note(s) [2025.01]

When classifying in this group, constituents of a material are considered irrespective of any dopants or other impurities.

20/823 • • • • *comprising only Group II-VI materials, e.g. ZnO* ***[2025.01]***

20/824 • • • • *comprising only Group III-V materials, e.g. GaP* ***[2025.01]***

20/825 • • • • • *containing nitrogen, e.g. GaN* ***[2025.01]***

20/826 • • • • *comprising only Group IV materials* ***[2025.01]***

20/83 • • *Electrodes* ***[2025.01]***

20/831 • • • *characterised by their shape* ***[2025.01]***

20/832 • • • *characterised by their material* ***[2025.01]***

20/833 • • • • *Transparent materials* ***[2025.01]***

20/84 • • *Coatings, e.g. passivation layers or antireflective coatings* ***[2025.01]***

20/841 • • • *Reflective coatings, e.g. dielectric Bragg reflectors* ***[2025.01]***

20/85 • • *Packages* ***[2025.01]***

20/851 • • • *Wavelength conversion means* ***[2025.01]***

20/852 • • • *Encapsulations* ***[2025.01]***

20/853 • • • • *characterised by their shape* ***[2025.01]***

20/854 • • • • *characterised by their material, e.g. epoxy or silicone resins* ***[2025.01]***

20/855 • • • *Optical field-shaping means, e.g. lenses* ***[2025.01]***

20/856 • • • • *Reflecting means* ***[2025.01]***

20/857 • • • *Interconnections, e.g. lead-frames, bond wires or solder balls* ***[2025.01]***

20/858 • • • *Means for heat extraction or cooling* ***[2025.01]***

29/00 Integrated devices, or assemblies of multiple devices, comprising at least one light-emitting semiconductor element covered by group H10H 20/00 [2025.01]

29/01 • *Manufacture or treatment* ***[2025.01]***

29/02 • • *using pick-and-place processes* ***[2025.01]***

29/03 • • *using mass transfer of LEDs, e.g. by using liquid suspensions* ***[2025.01]***

29/10 • *Integrated devices comprising at least one light-emitting semiconductor component covered by group H10H 20/00 (active-matrix LED displays H10H 29/30)* ***[2025.01]***

29/14 • • *comprising multiple light-emitting semiconductor components* ***[2025.01]***

29/20 • *Assemblies of multiple devices comprising at least one light-emitting semiconductor device covered by group H10H 20/00 (active-matrix LED displays H10H 29/30)* ***[2025.01]***

29/24 • • *comprising multiple light-emitting semiconductor devices* ***[2025.01]***

29/30 • *Active-matrix LED displays* ***[2025.01]***

Note(s) [2025.01]

This group covers active-matrix displays where the emphasis of the invention concerns the LEDs, the layers closely related to the LEDs or constructional details closely related to the LEDs, e.g. interconnections between the LEDs or their encapsulations.

29/32 • • *characterised by the geometry or arrangement of elements within a subpixel, e.g. arrangement of the transistor within its RGB subpixel* ***[2025.01]***

29/34 • • *characterised by the geometry or arrangement of subpixels within a pixel, e.g. relative disposition of the RGB subpixels* ***[2025.01]***

29/37 • • *Pixel-defining structures, e.g. banks between the LEDs* ***[2025.01]***

29/39 • • *Connection of the pixel electrodes to the driving transistors* ***[2025.01]***

29/41 • • *Insulating layers formed between the driving transistors and the LEDs* ***[2025.01]***

29/45 • • *comprising two substrates, each having active devices thereon, e.g. displays comprising LED arrays and driving circuitry on different substrates* ***[2025.01]***

29/49 • • *Interconnections, e.g. wiring lines or terminals (connection of the pixel electrodes to the driving transistors H10H 29/39)* ***[2025.01]***

29/80 • *Constructional details* ***[2025.01]***

Note(s) [2025.01]

Classification is made in group H10H 29/80 when the constructional detail is relevant to integrated devices or assemblies comprising multiple devices. When the constructional detail is relevant to individual devices, then classification is made in group H10H 20/80.

29/85 • • *Packages* ***[2025.01]***

29/851 • • • *Wavelength conversion means* ***[2025.01]***

29/852 • • • *Encapsulations* ***[2025.01]***

29/853 • • • • *characterised by their shape* ***[2025.01]***

29/854 • • • • *characterised by their material, e.g. epoxy or silicone resins* ***[2025.01]***

29/855 • • • *Optical field-shaping means, e.g. lenses* ***[2025.01]***

29/856 • • • • *Reflecting means* ***[2025.01]***

99/00 Subject matter not provided for in other groups of this subclass [2025.01]

H10K ORGANIC ELECTRIC SOLID-STATE DEVICES [2023.01]

Note(s) [2023.01]

1. This subclass covers:
   - individual organic electric solid-state devices, i.e. electric solid-state devices comprising organic material in the active part;
   - integrated devices, or assemblies of multiple devices, comprising such elements.
2. This subclass does not cover:
   - organic electronic memory devices, which are covered by subclass H10B;

- organic thermoelectric devices, organic thermomagnetic devices, organic piezoelectric devices, organic electrostrictive devices, organic magnetostrictive devices, organic galvanomagnetic devices, organic Hall-effect devices, organic superconducting devices or organic solid-state devices having no potential barriers, and specially adapted for rectifying, amplifying, oscillating or switching, which are covered by subclass H10N;
- organic resistors having no potential barriers and not specially adapted for integrated devices, which are covered by subclass H01C;
- organic capacitors having no potential barriers and not specially adapted for integrated devices, which are covered by subclass H01G.

3. 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.
4. In this subclass, it is desirable to add the indexing codes of groups H10K 101/00-H10K 102/00.

Subclass index

Organic devices specially adapted for rectifying, amplifying, oscillating or switching [2023.01]

10/00 **Organic devices specially adapted for rectifying, amplifying, oscillating or switching; Organic capacitors or resistors having potential barriers** (integrated devices or assemblies of multiple devices H10K 19/00) **[2023.01]**

10/10 • Organic capacitors or resistors having potential barriers **[2023.01]**
10/20 • Organic diodes **[2023.01]**
10/23 • • Schottky diodes **[2023.01]**
10/26 • • Diodes comprising organic-organic junctions **[2023.01]**
10/29 • • Diodes comprising organic-inorganic heterojunctions **[2023.01]**
10/40 • Organic transistors **[2023.01]**
10/43 • • Bipolar transistors, e.g. organic bipolar junction transistors [OBJT] **[2023.01]**
10/46 • • Field-effect transistors, e.g. organic thin-film transistors [OTFT] (H10K 10/43 takes precedence) **[2023.01]**
10/50 • Bistable switching devices **[2023.01]**
10/80 • Constructional details **[2023.01]**
10/82 • • Electrodes **[2023.01]**
10/84 • • • Ohmic electrodes, e.g. source or drain electrodes **[2023.01]**
10/86 • • • Schottky electrodes **[2023.01]**
10/88 • • Passivation; Containers; Encapsulations **[2023.01]**

19/00 **Integrated devices, or assemblies of multiple devices, comprising at least one organic element specially adapted for rectifying, amplifying, oscillating or switching, covered by group H10K 10/00 [2023.01]**

19/10 • comprising field-effect transistors **[2023.01]**
19/20 • comprising components having an active region that includes an inorganic semiconductor **[2023.01]**
19/80 • Interconnections, e.g. terminals **[2023.01]**

Organic radiation-sensitive devices [2023.01]

30/00 **Organic devices sensitive to infrared radiation, light, electromagnetic radiation of shorter wavelength or corpuscular radiation** (integrated devices or assemblies of multiple devices H10K 39/00, H10K 65/00; electrolytic light-sensitive devices H01G 9/20) **[2023.01]**

Note(s) [2023.01]

This group covers organic semiconductor devices sensitive to radiation insofar as these devices are specially adapted for either:
- the conversion of the radiation energy into electrical energy; or
- the control of electrical energy by such radiation.

30/10 • comprising heterojunctions between organic semiconductors and inorganic semiconductors **[2023.01]**
30/15 • • Sensitised wide-bandgap semiconductor devices, e.g. dye-sensitised TiO_2 (photo-electrochemical devices comprising a liquid electrolyte or a solid electrolyte H01G 9/20) **[2023.01]**
30/20 • comprising organic-organic junctions, e.g. donor-acceptor junctions **[2023.01]**
30/30 • comprising bulk heterojunctions, e.g. interpenetrating networks of donor and acceptor material domains **[2023.01]**

30/35 • • comprising inorganic nanostructures, e.g. CdSe nanoparticles **[2023.01]**
30/40 • comprising a p-i-n structure, e.g. having a perovskite absorber between p-type and n-type charge transport layers **[2023.01]**
30/50 • Photovoltaic [PV] devices **[2023.01]**
30/53 • • in the form of fibres or tubes, e.g. photovoltaic fibres **[2023.01]**
30/57 • • comprising multiple junctions, e.g. tandem PV cells **[2023.01]**
30/60 • in which radiation controls flow of current through the devices, e.g. photoresistors **[2023.01]**
30/65 • • Light-sensitive field-effect devices, e.g. phototransistors **[2023.01]**
30/80 • Constructional details **[2023.01]**
30/81 • • Electrodes **[2023.01]**
30/82 • • • Transparent electrodes, e.g. indium tin oxide [ITO] electrodes **[2023.01]**
30/83 • • • • comprising arrangements for extracting the current from the cell, e.g. metal finger grid systems to reduce the serial resistance of transparent electrodes **[2023.01]**
30/84 • • Layers having high charge carrier mobility **[2023.01]**
30/85 • • • Layers having high electron mobility, e.g. electron-transporting layers or hole-blocking layers **[2023.01]**
30/86 • • • Layers having high hole mobility, e.g. hole-transporting layers or electron-blocking layers **[2023.01]**
30/87 • • Light-trapping means **[2023.01]**
30/88 • • Passivation; Containers; Encapsulations **[2023.01]**
30/89 • • Terminals, e.g. bond pads **[2023.01]**

39/00 Integrated devices, or assemblies of multiple devices, comprising at least one organic radiation-sensitive element covered by group H10K 30/00 [2023.01]

Note(s) [2023.01]

This group only covers devices that are sensitive to infrared radiation, light, electromagnetic radiation of shorter wavelength or corpuscular radiation.

39/10 • Organic photovoltaic [PV] modules; Arrays of single organic PV cells **[2023.01]**
39/12 • • Electrical configurations of PV cells, e.g. series connections or parallel connections **[2023.01]**
39/15 • • comprising both organic PV cells and inorganic PV cells **[2023.01]**
39/18 • • Interconnections, e.g. terminals **[2023.01]**
39/30 • Devices controlled by radiation **[2023.01]**
39/32 • • Organic image sensors **[2023.01]**
39/34 • • • integrated with organic light-emitting diodes [OLED] **[2023.01]**
39/36 • • Devices specially adapted for detecting X-ray radiation **[2023.01]**
39/38 • • Interconnections, e.g. terminals **[2023.01]**

Organic light-emitting devices [2023.01]

50/00 Organic light-emitting devices (integrated devices or assemblies of multiple devices H10K 59/00, H10K 65/00; organic semiconductor lasers H01S 5/36) **[2023.01]**

50/10 • OLEDs or polymer light-emitting diodes [PLED] **[2023.01]**
50/11 • • characterised by the electroluminescent [EL] layers **[2023.01]**
50/115 • • • comprising active inorganic nanostructures, e.g. luminescent quantum dots **[2023.01]**
50/12 • • • comprising dopants **[2023.01]**
50/125 • • • specially adapted for multicolour light emission, e.g. for emitting white light **[2023.01]**
50/13 • • • • comprising stacked EL layers within one EL unit **[2023.01]**
50/135 • • • comprising mobile ions **[2023.01]**
50/14 • • Carrier transporting layers **[2023.01]**
50/15 • • • Hole transporting layers **[2023.01]**
50/155 • • • • comprising dopants **[2023.01]**
50/16 • • • Electron transporting layers **[2023.01]**
50/165 • • • • comprising dopants **[2023.01]**
50/17 • • Carrier injection layers **[2023.01]**
50/18 • • Carrier blocking layers **[2023.01]**
50/19 • • Tandem OLEDs **[2023.01]**
50/30 • Organic light-emitting transistors **[2023.01]**
50/80 • Constructional details **[2023.01]**
50/805 • • Electrodes **[2023.01]**
50/81 • • • Anodes **[2023.01]**
50/813 • • • • characterised by their shape **[2023.01]**
50/814 • • • • combined with auxiliary electrodes, e.g. ITO layer combined with metal lines **[2023.01]**
50/816 • • • • Multilayers, e.g. transparent multilayers **[2023.01]**
50/818 • • • • Reflective anodes, e.g. ITO combined with thick metallic layers **[2023.01]**
50/82 • • • Cathodes **[2023.01]**
50/822 • • • • characterised by their shape **[2023.01]**
50/824 • • • • combined with auxiliary electrodes **[2023.01]**
50/826 • • • • Multilayers, e.g. opaque multilayers **[2023.01]**
50/828 • • • • Transparent cathodes, e.g. comprising thin metal layers **[2023.01]**
50/84 • • Passivation; Containers; Encapsulations **[2023.01]**
50/842 • • • Containers **[2023.01]**
50/844 • • • Encapsulations **[2023.01]**
50/85 • • Arrangements for extracting light from the devices **[2023.01]**
50/852 • • • comprising a resonant cavity structure, e.g. Bragg reflector pair **[2023.01]**
50/854 • • • comprising scattering means **[2023.01]**
50/856 • • • comprising reflective means **[2023.01]**
50/858 • • • comprising refractive means, e.g. lenses **[2023.01]**
50/86 • • Arrangements for improving contrast, e.g. preventing reflection of ambient light **[2023.01]**
50/87 • • Arrangements for heating or cooling **[2023.01]**
50/88 • • Terminals, e.g. bond pads **[2023.01]**

59/00 Integrated devices, or assemblies of multiple devices, comprising at least one organic light-emitting element covered by group H10K 50/00 [2023.01]

59/10 • OLED displays **[2023.01]**
59/12 • • Active-matrix OLED [AMOLED] displays **[2023.01]**
59/121 • • • characterised by the geometry or disposition of pixel elements **[2023.01]**
59/122 • • • Pixel-defining structures or layers, e.g. banks **[2023.01]**

59/123 • • • Connection of the pixel electrodes to the thin film transistors [TFT] **[2023.01]**
59/124 • • • Insulating layers formed between TFT elements and OLED elements **[2023.01]**
59/125 • • • including organic TFTs [OTFT] **[2023.01]**
59/126 • • • Shielding, e.g. light-blocking means over the TFTs **[2023.01]**
59/127 • • • comprising two substrates, e.g. display comprising OLED array and TFT driving circuitry on different substrates **[2023.01]**
59/128 • • • comprising two independent displays, e.g. for emitting information from two major sides of the display **[2023.01]**
59/129 • • • Chiplets **[2023.01]**
59/13 • • • comprising photosensors that control luminance **[2023.01]**
59/131 • • • Interconnections, e.g. wiring lines or terminals **[2023.01]**
59/17 • • Passive-matrix OLED displays **[2023.01]**
59/173 • • • comprising banks or shadow masks **[2023.01]**
59/176 • • • comprising two independent displays, e.g. for emitting information from two major sides of the display **[2023.01]**
59/179 • • • Interconnections, e.g. wiring lines or terminals **[2023.01]**
59/18 • • Tiled displays **[2023.01]**
59/19 • • Segment displays **[2023.01]**
59/30 • Devices specially adapted for multicolour light emission **[2023.01]**
59/32 • • Stacked devices having two or more layers, each emitting at different wavelengths **[2023.01]**
59/35 • • comprising red-green-blue [RGB] subpixels **[2023.01]**
59/38 • • comprising colour filters or colour changing media [CCM] **[2023.01]**
59/40 • OLEDs integrated with touch screens **[2023.01]**
59/50 • OLEDs integrated with light modulating elements, e.g. with electrochromic elements, photochromic elements or liquid crystal elements **[2023.01]**
59/60 • OLEDs integrated with inorganic light-sensitive elements, e.g. with inorganic solar cells or inorganic photodiodes **[2023.01]**
59/65 • • OLEDs integrated with inorganic image sensors **[2023.01]**
59/70 • OLEDs integrated with inorganic light-emitting elements, e.g. with inorganic electroluminescent elements **[2023.01]**
59/80 • Constructional details **[2023.01]**
59/82 • • Interconnections, e.g. terminals (H10K 59/131, H10K 59/179 take precedence) **[2023.01]**
59/84 • • Parallel electrical configurations of multiple OLEDs **[2023.01]**
59/86 • • Series electrical configurations of multiple OLEDs **[2023.01]**
59/88 • • Dummy elements, i.e. elements having non-functional features **[2023.01]**
59/90 • Assemblies of multiple devices comprising at least one organic light-emitting element **[2023.01]**
59/95 • • wherein all light-emitting elements are organic, e.g. assembled OLED displays **[2023.01]**

65/00 Integrated devices, or assemblies of multiple devices, comprising at least one organic light-emitting element and at least one organic radiation-sensitive element, e.g. organic opto-couplers (organic image sensors integrated with organic light-emitting devices H10K 39/34; OLED displays integrated with photosensors H10K 59/13) **[2023.01]**

Manufacture or treatment; Constructional details [2023.01]

71/00 Manufacture or treatment specially adapted for the organic devices covered by this subclass [2023.01]
71/10 • Deposition of organic active material **[2023.01]**
71/12 • • using liquid deposition, e.g. spin coating **[2023.01]**
71/13 • • • using printing techniques, e.g. ink-jet printing or screen printing **[2023.01]**
71/15 • • • characterised by the solvent used **[2023.01]**
71/16 • • using physical vapour deposition [PVD], e.g. vacuum deposition or sputtering **[2023.01]**
71/18 • • using non-liquid printing techniques, e.g. thermal transfer printing from a donor sheet **[2023.01]**
71/20 • Changing the shape of the active layer in the devices, e.g. patterning **[2023.01]**
71/30 • Doping active layers, e.g. electron transporting layers **[2023.01]**
71/40 • Thermal treatment, e.g. annealing in the presence of a solvent vapour **[2023.01]**
71/50 • Forming devices by joining two substrates together, e.g. lamination techniques **[2023.01]**
71/60 • Forming conductive regions or layers, e.g. electrodes **[2023.01]**
71/70 • Testing, e.g. accelerated lifetime tests **[2023.01]**
71/80 • using temporary substrates **[2023.01]**

77/00 Constructional details of devices covered by this subclass and not covered by groups H10K 10/80, H10K 30/80, H10K 50/80 or H10K 59/80 [2023.01]
77/10 • Substrates, e.g. flexible substrates **[2023.01]**

85/00 Organic materials used in the body or electrodes of devices covered by this subclass [2023.01]

Note(s) [2023.01]

This group only covers organic materials for their electrical or other properties, insofar as they are specially adapted for the devices covered by this subclass.

85/10 • Organic polymers or oligomers **[2023.01]**
85/20 • Carbon compounds, e.g. carbon nanotubes or fullerenes **[2023.01]**
85/30 • Coordination compounds **[2023.01]**
85/40 • Organosilicon compounds, e.g. TIPS pentacene **[2023.01]**
85/50 • Organic perovskites; Hybrid organic-inorganic perovskites [HOIP], e.g. $CH_3NH_3PbI_3$ **[2023.01]**
85/60 • Organic compounds having low molecular weight (H10K 85/10-H10K 85/50 take precedence) **[2023.01]**

99/00 Subject matter not provided for in other groups of this subclass [2023.01]

Indexing scheme associated with group H10K 85/00, relating to properties of organic materials [2023.01]

101/00 Properties of the organic materials covered by group H10K 85/00 [2023.01]

101/10 • Triplet emission **[2023.01]**
101/20 • Delayed fluorescence emission **[2023.01]**
101/25 • • using exciplex **[2023.01]**
101/30 • Highest occupied molecular orbital [HOMO], lowest unoccupied molecular orbital [LUMO] or Fermi energy values **[2023.01]**
101/40 • Interrelation of parameters between multiple constituent active layers or sublayers, e.g. HOMO values in adjacent layers **[2023.01]**
101/50 • Oxidation-reduction potentials, e.g. excited state redox potentials **[2023.01]**
101/60 • Up-conversion, e.g. by triplet-triplet annihilation **[2023.01]**
101/70 • Down-conversion, e.g. by singlet fission **[2023.01]**

Indexing scheme associated with groups H10K 10/80, H10K 30/80, H10K 50/80, H10K 59/80 and H10K 77/00, relating to constructional details [2023.01]

102/00 Constructional details relating to the organic devices covered by this subclass [2023.01]

102/10 • Transparent electrodes, e.g. using graphene **[2023.01]**
102/20 • Metallic electrodes, e.g. using a stack of layers **[2023.01]**

H10N ELECTRIC SOLID-STATE DEVICES NOT OTHERWISE PROVIDED FOR [2023.01]

Note(s) [2024.01]

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.

Subclass index

Thermoelectric or thermomagnetic devices [2023.01]

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) **[2023.01]**

Note(s) [2023.01]

This group covers thermoelectric devices comprising a junction of dissimilar materials, with or without other thermoelectric or thermomagnetic effects.

10/01 • Manufacture or treatment **[2023.01]**
10/10 • operating with only the Peltier or Seebeck effects **[2023.01]**
10/13 • • characterised by the heat-exchanging means at the junction **[2023.01]**
10/17 • • characterised by the structure or configuration of the cell or thermocouple forming the device **[2023.01]**
10/80 • Constructional details **[2023.01]**
10/81 • • Structural details of the junction **[2023.01]**
10/813 • • • the junction being separable, e.g. using a spring **[2023.01]**

10/817 • • • the junction being non- separable, e.g. being cemented, sintered or soldered **[2023.01]**
10/82 • • Interconnections **[2023.01]**
10/85 • • Thermoelectric active materials **[2023.01]**
10/851 • • • comprising inorganic compositions **[2023.01]**
10/852 • • • • comprising tellurium, selenium or sulfur **[2023.01]**
10/853 • • • • comprising arsenic, antimony or bismuth (H10N 10/852 takes precedence) **[2023.01]**
10/854 • • • • comprising only metals (H10N 10/852, H10N 10/853 take precedence) **[2023.01]**
10/855 • • • • comprising compounds containing boron, carbon, oxygen or nitrogen **[2023.01]**
10/856 • • • comprising organic compositions **[2023.01]**
10/857 • • • comprising compositions changing continuously or discontinuously inside the material **[2023.01]**

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) **[2023.01]**
15/10 • Thermoelectric devices using thermal change of the dielectric constant, e.g. working above and below the Curie point **[2023.01]**
15/20 • Thermomagnetic devices using thermal change of the magnetic permeability, e.g. working above and below the Curie point **[2023.01]**

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 [2023.01]

Piezoelectric, electrostrictive or magnetostrictive devices [2023.01]

30/00 Piezoelectric or electrostrictive devices (integrated devices or assemblies of multiple devices H10N 39/00) **[2023.01]**
30/01 • Manufacture or treatment **[2023.01]**
30/02 • • Forming enclosures or casings **[2023.01]**
30/03 • • Assembling devices that include piezoelectric or electrostrictive parts **[2023.01]**
30/04 • • Treatments to modify a piezoelectric or electrostrictive property, e.g. polarisation characteristics, vibration characteristics or mode tuning **[2023.01]**
30/045 • • • by polarising **[2023.01]**
30/05 • • Manufacture of multilayered piezoelectric or electrostrictive devices, or parts thereof, e.g. by stacking piezoelectric bodies and electrodes **[2023.01]**
30/053 • • • by integrally sintering piezoelectric or electrostrictive bodies and electrodes **[2023.01]**
30/057 • • • by stacking bulk piezoelectric or electrostrictive bodies and electrodes **[2023.01]**
30/06 • • Forming electrodes or interconnections, e.g. leads or terminals **[2023.01]**
30/063 • • • Forming interconnections, e.g. connection electrodes of multilayered piezoelectric or electrostrictive parts **[2023.01]**
30/067 • • • Forming single-layered electrodes of multilayered piezoelectric or electrostrictive parts **[2023.01]**
30/07 • • Forming of piezoelectric or electrostrictive parts or bodies on an electrical element or another base **[2023.01]**
30/071 • • • Mounting of piezoelectric or electrostrictive parts together with semiconductor elements, or other circuit elements, on a common substrate **[2023.01]**
30/072 • • • by laminating or bonding of piezoelectric or electrostrictive bodies **[2023.01]**
30/073 • • • • by fusion of metals or by adhesives **[2023.01]**
30/074 • • • by depositing piezoelectric or electrostrictive layers, e.g. aerosol or screen printing **[2023.01]**
30/076 • • • • by vapour phase deposition **[2023.01]**
30/077 • • • • by liquid phase deposition **[2023.01]**
30/078 • • • • • by sol-gel deposition **[2023.01]**
30/079 • • • • using intermediate layers, e.g. for growth control **[2023.01]**
30/08 • • Shaping or machining of piezoelectric or electrostrictive bodies **[2023.01]**
30/081 • • • by coating or depositing using masks, e.g. lift-off **[2023.01]**
30/082 • • • by etching, e.g. lithography **[2023.01]**
30/084 • • • by moulding or extrusion **[2023.01]**
30/085 • • • by machining **[2023.01]**
30/086 • • • • by polishing or grinding **[2023.01]**
30/088 • • • • by cutting or dicing **[2023.01]**
30/089 • • • • by punching **[2023.01]**
30/09 • • Forming piezoelectric or electrostrictive materials **[2023.01]**
30/092 • • • Forming composite materials **[2023.01]**
30/093 • • • Forming inorganic materials **[2023.01]**
30/095 • • • • by melting **[2023.01]**
30/097 • • • • by sintering **[2023.01]**
30/098 • • • Forming organic materials **[2023.01]**
30/20 • with electrical input and mechanical output, e.g. functioning as actuators or vibrators **[2023.01]**
30/30 • with mechanical input and electrical output, e.g. functioning as generators or sensors **[2023.01]**
30/40 • with electrical input and electrical output, e.g. functioning as transformers **[2023.01]**
30/50 • having a stacked or multilayer structure **[2023.01]**
30/60 • having a coaxial cable structure **[2023.01]**
30/80 • Constructional details **[2023.01]**
30/85 • • Piezoelectric or electrostrictive active materials **[2023.01]**
30/853 • • • Ceramic compositions **[2023.01]**
30/857 • • • Macromolecular compositions **[2023.01]**
30/87 • • Electrodes or interconnections, e.g. leads or terminals **[2023.01]**
30/88 • • Mounts; Supports; Enclosures; Casings **[2023.01]**

35/00 Magnetostrictive devices (integrated devices or assemblies of multiple devices H10N 39/00) **[2023.01]**
35/01 • Manufacture or treatment **[2023.01]**
35/80 • Constructional details **[2023.01]**
35/85 • • Magnetostrictive active materials **[2023.01]**

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 [2023.01]

Galvanomagnetic or similar magnetic-effect devices [2023.01]

50/00 **Galvanomagnetic devices** (Hall-effect devices H10N 52/00; integrated devices or assemblies of multiple devices H10N 59/00) **[2023.01]**
50/01 • Manufacture or treatment **[2023.01]**
50/10 • Magnetoresistive devices **[2023.01]**
50/20 • Spin-polarised current-controlled devices (magnetoresistive devices H10N 50/10) **[2023.01]**
50/80 • Constructional details **[2023.01]**
50/85 • • Materials of the active region **[2023.01]**

52/00 **Hall-effect devices** (integrated devices or assemblies of multiple devices H10N 59/00) **[2023.01]**
52/01 • Manufacture or treatment **[2023.01]**
52/80 • Constructional details **[2023.01]**
52/85 • • Materials of the active region **[2023.01]**

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) **[2023.01]**

Superconducting devices [2023.01]

60/00 **Superconducting devices** (integrated devices or assemblies of multiple devices H10N 69/00) **[2023.01]**
60/01 • Manufacture or treatment **[2023.01]**
60/10 • Junction-based devices **[2023.01]**
60/12 • • Josephson-effect devices **[2023.01]**
60/20 • Permanent superconducting devices **[2023.01]**
60/30 • Devices switchable between superconducting and normal states **[2023.01]**
60/35 • • Cryotrons **[2023.01]**
60/355 • • • Power cryotrons **[2023.01]**
60/80 • Constructional details **[2023.01]**
60/81 • • Containers; Mountings **[2023.01]**
60/82 • • Current path **[2023.01]**
60/83 • • Element shape **[2023.01]**
60/84 • • Switching means for devices switchable between superconducting and normal states **[2023.01]**
60/85 • • Superconducting active materials **[2023.01]**

69/00 **Integrated devices, or assemblies of multiple devices, comprising at least one superconducting element covered by group H10N 60/00 [2023.01]**

Other electric solid-state devices [2023.01]

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) **[2023.01]**
70/10 • Solid-state travelling-wave devices **[2023.01]**
70/20 • Multistable switching devices, e.g. memristors **[2023.01]**

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) **[2023.01]**

80/00 **Bulk negative-resistance effect devices** (integrated devices or assemblies of multiple devices H10N 89/00) **[2023.01]**
80/10 • Gunn-effect devices **[2023.01]**

89/00 **Integrated devices, or assemblies of multiple devices, comprising at least one bulk negative resistance effect element covered by group H10N 80/00 [2023.01]**

97/00 **Electric solid-state thin-film or thick-film devices, not otherwise provided for [2023.01]**

99/00 **Subject matter not provided for in other groups of this subclass [2023.01]**