

CPC COOPERATIVE PATENT CLASSIFICATION

H ELECTRICITY

(NOTE omitted)

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

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

NOTES

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.

Photovoltaics

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

WARNING

Group [H10F 10/00](#) is incomplete pending reclassification of documents from group [H10F 99/00](#).

Groups [H10F 99/00](#) and [H10F 10/00](#) should be considered in order to perform a complete search.

- | | | | |
|---------|---|--------|--|
| 10/10 | . having potential barriers | 10/163 | . . . comprising only Group III-V materials, e.g. GaAs/AlGaAs or InP/GaInAs photovoltaic cells |
| 10/11 | . . Photovoltaic cells having point contact potential barriers (H10F 10/18 takes precedence) | 10/164 | . . . comprising heterojunctions with Group IV materials, e.g. ITO/Si or GaAs/SiGe photovoltaic cells |
| 10/12 | . . Photovoltaic cells having only metal-insulator-semiconductor [MIS] potential barriers | 10/165 | the heterojunctions being Group IV-IV heterojunctions, e.g. Si/Ge, SiGe/Si or Si/SiC photovoltaic cells |
| 10/13 | . . Photovoltaic cells having absorbing layers comprising graded bandgaps | 10/166 | the Group IV-IV heterojunctions being heterojunctions of crystalline and amorphous materials, e.g. silicon heterojunction [SHJ] photovoltaic cells |
| 10/14 | . . Photovoltaic cells having only PN homojunction potential barriers | 10/167 | . . . comprising Group I-III-VI materials, e.g. CdS/CuInSe ₂ [CIS] heterojunction photovoltaic cells |
| 10/142 | . . . comprising multiple PN homojunctions, e.g. tandem cells | 10/169 | . . . {comprising Cu ₂ X/CdX heterojunctions, wherein X is a Group VI element, e.g. Cu ₂ O/CdO PN heterojunction photovoltaic cells} |
| 10/1425 | {Inverted metamorphic multi-junction [IMM] photovoltaic cells} | 10/17 | . . Photovoltaic cells having only PIN junction potential barriers |
| 10/144 | . . . comprising only Group III-V materials, e.g. GaAs, AlGaAs, or InP photovoltaic cells | 10/172 | . . . comprising multiple PIN junctions, e.g. tandem cells |
| 10/146 | . . . {Back-junction photovoltaic cells, e.g. having interdigitated base-emitter regions on the back side} | 10/174 | . . . comprising monocrystalline or polycrystalline materials |
| 10/148 | . . . {Double-emitter photovoltaic cells, e.g. bifacial photovoltaic cells} | 10/18 | . . Photovoltaic cells having only Schottky potential barriers |
| 10/16 | . . Photovoltaic cells having only PN heterojunction potential barriers | 10/19 | . . Photovoltaic cells having multiple potential barriers of different types, e.g. tandem cells having both PN and PIN junctions |
| 10/161 | . . . comprising multiple PN heterojunctions, e.g. tandem cells | | |
| 10/162 | . . . comprising only Group II-VI materials, e.g. CdS/CdTe photovoltaic cells | | |

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

WARNING

Group [H10F 19/00](#) is incomplete pending reclassification of documents from group [H10F 99/00](#).

Groups [H10F 99/00](#) and [H10F 19/00](#) should be considered in order to perform a complete search.

- 19/10 . comprising photovoltaic cells in arrays in a single semiconductor substrate, the photovoltaic cells having vertical junctions or V-groove junctions
- 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](#))
- 19/30 . comprising thin-film photovoltaic cells
- 19/31 . . having multiple laterally adjacent thin-film photovoltaic cells deposited on the same substrate
- 19/33 . . . Patterning processes to connect the photovoltaic cells, e.g. laser cutting of conductive or active layers
- 19/35 . . . Structures for the connecting of adjacent photovoltaic cells, e.g. interconnections or insulating spacers
- 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
- 19/40 . comprising photovoltaic cells in a mechanically stacked configuration
- 19/50 . Integrated devices comprising at least one photovoltaic cell and other types of semiconductor or solid-state components ([H10F 19/75](#) takes precedence)
- 19/70 . comprising bypass diodes (bypass diodes in a junction box [H02S 40/34](#))
- 19/75 . . the bypass diodes being integrated or directly associated with the photovoltaic cells, e.g. formed in or on the same substrate
- 19/80 . Encapsulations or containers for integrated devices, or assemblies of multiple devices, having photovoltaic cells
- 19/804 . . {Materials of encapsulations}
- 19/807 . . {Double-glass encapsulation, e.g. photovoltaic cells arranged between front and rear glass sheets}
- 19/85 . . Protective back sheets
- 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](#))
- 19/902 . . {for series or parallel connection of photovoltaic cells}
- 19/904 . . . {characterised by the shapes of the structures}
- 19/906 . . . {characterised by the materials of the structures}
- 19/908 . . . {for back-contact photovoltaic cells}

Radiation-controlled devices

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

WARNING

Group [H10F 30/00](#) is incomplete pending reclassification of documents from group [H10F 99/00](#).

Groups [H10F 99/00](#) and [H10F 30/00](#) should be considered in order to perform a complete search.

- 30/10 . the devices being sensitive to infrared radiation, visible or ultraviolet radiation, and having no potential barriers, e.g. photoresistors
- 30/15 . . {comprising amorphous semiconductors}
- 30/20 . the devices having potential barriers, e.g. phototransistors
- 30/21 . . the devices being sensitive to infrared, visible or ultraviolet radiation
- 30/22 . . . the devices having only one potential barrier, e.g. photodiodes
- 30/2205 {the potential barrier being a point contact}
- 30/221 the potential barrier being a PN homojunction
- 30/2212 {the devices comprising active layers made of only Group II-VI materials, e.g. HgCdTe infrared photodiodes}
- 30/2215 {the devices comprising active layers made of only Group III-V materials}
- 30/2218 {the devices comprising active layers made of only Group IV-VI materials}
- 30/222 the potential barrier being a PN heterojunction
- 30/223 the potential barrier being a PIN barrier
- 30/2235 {the devices comprising Group IV amorphous materials}
- 30/225 the potential barrier working in avalanche mode, e.g. avalanche photodiodes
- 30/2255 {in which the active layers form heterostructures, e.g. SAM structures}
- 30/227 the potential barrier being a Schottky barrier
- 30/2275 {being a metal-semiconductor-metal [MSM] Schottky barrier}
- 30/24 . . . the devices having only two potential barriers, e.g. bipolar phototransistors
- 30/245 {Bipolar phototransistors}
- 30/26 . . . the devices having three or more potential barriers, e.g. photothyristors
- 30/263 {Photothyristors}
- 30/2635 {Static induction photothyristors}
- 30/28 . . . the devices being characterised by field-effect operation, e.g. junction field-effect phototransistors
- 30/282 Insulated-gate field-effect transistors [IGFET], e.g. MISFET [metal-insulator-semiconductor field-effect transistor] phototransistors
- 30/2823 {the devices being conductor-insulator-semiconductor devices, e.g. diodes or charge-coupled devices [CCD] (Insulated-gate field-effect transistors [H10F 30/282](#))}
- 30/283 {the devices having Schottky gates}
- 30/2837 {CCDs having Schottky gates}

30/2843	. . . . . {Schottky gate FETs, e.g. photo MESFETs}	39/107	. . {having multiple elements covered by H10F 30/00 in a repetitive configuration, e.g. radiation detectors comprising photodiode arrays}
30/285	. . . . . {the devices having PN homojunction gates}	39/12	. . Image sensors
30/2857	. . . . . {CCDs having PN homojunction gates}	39/15	. . . Charge-coupled device [CCD] image sensors
30/2863	. . . . . {Field-effect phototransistors having PN homojunction gates}	39/151	. . . . . {Geometry or disposition of pixel elements, address lines or gate electrodes}
30/287	. . . . . {the devices having PN heterojunction gates}	39/1515	. . . . . {Optical shielding}
30/2873	. . . . . {CCDs having PN heterojunction gates}	39/152	. . . . . {One-dimensional array CCD image sensors}
30/2877	. . . . . {Field-effect phototransistors having PN heterojunction gates}	39/153	. . . . . {Two-dimensional or three-dimensional array CCD image sensors}
30/288	. . . {the devices being sensitive to multiple wavelengths, e.g. multi-spectrum radiation detection devices}	39/1532	. . . . . {Frame-interline transfer}
30/289	. . . {the devices being transparent or semi-transparent devices}	39/1534	. . . . . {Interline transfer}
30/29	. . the devices being sensitive to radiation having very short wavelengths, e.g. X-rays, gamma-rays or corpuscular radiation	39/1536	. . . . . {Frame transfer}
30/292	. . . Bulk-effect radiation detectors, e.g. Ge-Li compensated PIN gamma-ray detectors	39/1538	. . . . . {Time-delay and integration}
30/2925	. . . . . {Li-compensated PIN gamma-ray detectors}	39/154	. . . . . {Charge-injection device [CID] image sensors (H10F 39/156 , H10F 39/157 take precedence)}
30/295	. . . Surface barrier or shallow PN junction radiation detectors, e.g. surface barrier alpha-particle detectors	39/156	. . . . . {CCD or CID colour image sensors}
30/2955	. . . . . {Shallow PN junction radiation detectors}	39/157	. . . . . {CCD or CID infrared image sensors}
30/298	. . . the devices being characterised by field-effect operation, e.g. MIS type detectors	39/1575	. . . . . {of the hybrid type}
30/301	. {the devices being sensitive to very short wavelength, e.g. being sensitive to X-rays, gamma-rays or corpuscular radiation}	39/158	. . . . . {having arrangements for blooming suppression}
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	39/159	. . . . . {comprising a photoconductive layer deposited on the CCD structure}
	WARNING	39/18	. . . Complementary metal-oxide-semiconductor [CMOS] image sensors; Photodiode array image sensors
	Groups H10F 39/00 and H10F 39/10 are incomplete pending reclassification of documents from group H10F 99/00 .	39/182	. . . . . {Colour image sensors}
	Groups H10F 99/00 , H10F 39/00 and H10F 39/10 should be considered in order to perform a complete search.	39/1825	. . . . . {Multicolour image sensors having stacked structure, e.g. NPN, NPNPN or multiple quantum well [MQW] structures}
39/011	. {Manufacture or treatment of image sensors covered by group H10F 39/12 }	39/184	. . . . . {Infrared image sensors}
39/014	. . {of CMOS image sensors}	39/1843	. . . . . {of the hybrid type}
39/016	. . {of thin-film-based image sensors}	39/1847	. . . . . {Multispectral infrared image sensors having a stacked structure, e.g. NPN, NPNPN or multiple quantum well [MQW] structures}
39/018	. . {of hybrid image sensors}	39/186	. . . . . {having arrangements for blooming suppression}
39/021	. . {of image sensors having active layers comprising only Group III-V materials, e.g. GaAs, AlGaAs or InP}	39/1865	. . . . . {Overflow drain structures}
39/022	. . {of image sensors having active layers comprising only Group II-VI materials, e.g. CdS, ZnS or CdTe}	39/189	. . . . . {X-ray, gamma-ray or corpuscular radiation imagers}
39/024	. . {of coatings or optical elements}	39/1892	. . . . . {Direct radiation image sensors}
39/026	. . {Wafer-level processing}	39/1895	. . . . . {of the hybrid type}
39/028	. . {performed after manufacture of the image sensors, e.g. annealing, gettering of impurities, short-circuit elimination or recrystallisation}	39/1898	. . . . . {Indirect radiation image sensors, e.g. using luminescent members}
39/10	. Integrated devices	39/191	. . . {Photoconductor image sensors}
39/103	. . {the at least one element covered by H10F 30/00 having potential barriers, e.g. integrated devices comprising photodiodes or phototransistors}	39/192	. . . . . {Colour image sensors}
		39/193	. . . . . {Infrared image sensors}
		39/1935	. . . . . {of the hybrid type}
		39/194	. . . . . {having arrangements for blooming suppression}
		39/1945	. . . . . {Overflow drain structures}
		39/195	. . . . . {X-ray, gamma-ray or corpuscular radiation imagers}
		39/196	. . . {Junction field effect transistor [JFET] image sensors; Static induction transistor [SIT] image sensors}
		39/197	. . . {Bipolar transistor image sensors}
		39/198	. . . {Contact-type image sensors [CIS]}
		39/199	. . . {Back-illuminated image sensors}

- 39/80 . . {Constructional details of image sensors}
- WARNING**
- Group [H10F 39/80](#) is impacted by reclassification into groups [H10F 39/802](#), [H10F 39/8023](#), [H10F 39/8027](#), [H10F 39/803](#), [H10F 39/8033](#), [H10F 39/8037](#), [H10F 39/80373](#), [H10F 39/80377](#), [H10F 39/804](#), [H10F 39/805](#), [H10F 39/8053](#), [H10F 39/8057](#), [H10F 39/806](#), [H10F 39/8063](#), [H10F 39/8067](#), [H10F 39/807](#), [H10F 39/809](#), [H10F 39/811](#), [H10F 39/812](#) and [H10F 39/813](#).
- All groups listed in this Warning should be considered in order to perform a complete search.

- 39/802 . . {Geometry or disposition of elements in pixels, e.g. address-lines or gate electrodes}
- WARNING**
- Groups [H10F 39/802](#) - [H10F 39/8027](#) are incomplete pending reclassification of documents from group [H10F 39/80](#).
- All groups listed in this Warning should be considered in order to perform a complete search.

- 39/8023 . . . {Disposition of the elements in pixels, e.g. smaller elements in the centre of the imager compared to larger elements at the periphery}
- 39/8027 . . . {Geometry of the photosensitive area}
- 39/803 . . {Pixels having integrated switching, control, storage or amplification elements}
- WARNING**
- Groups [H10F 39/803](#) - [H10F 39/80377](#) are incomplete pending reclassification of documents from group [H10F 39/80](#).
- All groups listed in this Warning should be considered in order to perform a complete search.

- 39/8033 . . . {Photosensitive area}
- 39/8037 . . . {the integrated elements comprising a transistor}
- 39/80373 {characterised by the gate of the transistor}
- 39/80377 {characterised by the channel of the transistor, e.g. channel having a doping gradient}
- 39/804 . . {Containers or encapsulations}

WARNING

Group [H10F 39/804](#) is incomplete pending reclassification of documents from group [H10F 39/80](#).

Groups [H10F 39/80](#) and [H10F 39/804](#) should be considered in order to perform a complete search.

- 39/805 . . {Coatings}
- WARNING**
- Groups [H10F 39/805](#) - [H10F 39/8057](#) are incomplete pending reclassification of documents from group [H10F 39/80](#).
- All groups listed in this Warning should be considered in order to perform a complete search.
- 39/8053 . . . {Colour filters}
- 39/8057 . . . {Optical shielding}
- 39/806 . . {Optical elements or arrangements associated with the image sensors}

WARNING

Groups [H10F 39/806](#) - [H10F 39/8067](#) are incomplete pending reclassification of documents from group [H10F 39/80](#).

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

- 39/8063 . . . {Microlenses}
- 39/8067 . . . {Reflectors}
- 39/807 . . {Pixel isolation structures}

WARNING

Group [H10F 39/807](#) is incomplete pending reclassification of documents from group [H10F 39/80](#).

Groups [H10F 39/80](#) and [H10F 39/807](#) should be considered in order to perform a complete search.

- 39/809 . . {of hybrid image sensors}

WARNING

Group [H10F 39/809](#) is incomplete pending reclassification of documents from group [H10F 39/80](#).

Groups [H10F 39/80](#) and [H10F 39/809](#) should be considered in order to perform a complete search.

- 39/811 . . {Interconnections}

WARNING

Group [H10F 39/811](#) is incomplete pending reclassification of documents from group [H10F 39/80](#).

Groups [H10F 39/80](#) and [H10F 39/811](#) should be considered in order to perform a complete search.

- 39/812 . . {Arrangements for transferring the charges in the image sensor perpendicular to the imaging plane, e.g. buried regions used to transfer generated charges to circuitry under the photosensitive region}

WARNING

Group [H10F 39/812](#) is incomplete pending reclassification of documents from group [H10F 39/80](#).

Groups [H10F 39/80](#) and [H10F 39/812](#) should be considered in order to perform a complete search.

- 39/813 . . {Electronic components shared by multiple pixels, e.g. one amplifier shared by two pixels}

WARNING

Group [H10F 39/813](#) is incomplete pending reclassification of documents from group [H10F 39/80](#).

Groups [H10F 39/80](#) and [H10F 39/813](#) should be considered in order to perform a complete search.

- 39/90 . Assemblies of multiple devices

WARNING

Groups [H10F 39/90](#) and [H10F 39/95](#) are incomplete pending reclassification of documents from group [H10W 90/00](#).

Groups [H10W 90/00](#), [H10F 39/90](#) and [H10F 39/95](#) should be considered in order to perform a complete search.

- 39/95 . . comprising at least one integrated device covered by group [H10F 39/10](#), e.g. comprising integrated image sensors

Other devices

- 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**

- 55/10 . wherein the radiation-sensitive semiconductor devices control the electric light source, e.g. image converters, image amplifiers or image storage devices
- 55/15 . . wherein the radiation-sensitive devices and the electric light source are all semiconductor devices
- 55/155 . . . formed in, or on, a common substrate
- 55/16 . . {wherein the radiation-sensitive semiconductor devices have no potential barriers}
- 55/165 . . . {wherein the electric light source comprises semiconductor devices having potential barriers, e.g. light emitting diodes}
- 55/17 . . {wherein the radiation-sensitive semiconductor devices have potential barriers}
- 55/18 . {wherein the radiation-sensitive semiconductor devices and the electric light source share a common body having dual-functionality of light emission and light detection}
- 55/20 . wherein the electric light source controls the radiation-sensitive semiconductor devices, e.g. optocouplers

- 55/205 . . {wherein the radiation-sensitive semiconductor devices have no potential barriers, e.g. photoresistors}

- 55/207 . . . {wherein the electric light source comprises semiconductor devices having potential barriers, e.g. light emitting diodes}

- 55/208 . . . {Optical potentiometers}

- 55/25 . . wherein the radiation-sensitive devices and the electric light source are all semiconductor devices

- 55/255 . . . formed in, or on, a common substrate

- 55/26 . . {wherein the radiation-sensitive semiconductor devices have potential barriers}

Manufacture or treatment; Constructional details

- 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](#))**

WARNING

Group [H10F 71/00](#) is impacted by reclassification into groups [H10F 71/128](#), [H10F 71/129](#), [H10F 71/131](#), [H10F 71/132](#), [H10F 71/133](#), [H10F 71/134](#), [H10F 71/135](#) and [H10F 71/136](#).

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

- 71/10 . the devices comprising amorphous semiconductor material

WARNING

Group [H10F 71/10](#) is impacted by reclassification into groups [H10F 71/103](#), [H10F 71/1035](#), [H10F 71/107](#), [H10F 71/128](#), [H10F 71/129](#), [H10F 71/131](#), [H10F 71/132](#), [H10F 71/133](#), [H10F 71/134](#), [H10F 71/135](#), [H10F 71/136](#), [H10F 71/137](#), [H10F 71/1375](#), [H10F 71/138](#), [H10F 71/1385](#), [H10F 71/139](#) and [H10F 71/1395](#).

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

- 71/103 . . {including only Group IV materials}

WARNING

Groups [H10F 71/103](#) and [H10F 71/1035](#) are incomplete pending reclassification of documents from group [H10F 71/10](#).

Groups [H10F 71/10](#), [H10F 71/103](#) and [H10F 71/1035](#) should be considered in order to perform a complete search.

- 71/1035 . . . {having multiple Group IV elements, e.g. SiGe or SiC}

- 71/107 . . {Continuous treatment of the devices, e.g. roll-to-roll processes or multi-chamber deposition}
 - WARNING**
 - Group [H10F 71/107](#) is incomplete pending reclassification of documents from group [H10F 71/10](#).
 - Groups [H10F 71/10](#) and [H10F 71/107](#) should be considered in order to perform a complete search.
- 71/121 . {The active layers comprising only Group IV materials}
 - 71/1212 . . {consisting of germanium}
 - 71/1215 . . {comprising at least two Group IV elements, e.g. SiGe}
 - 71/1218 . . . {in microcrystalline form}
 - 71/1221 . . {comprising polycrystalline silicon}
 - 71/1224 . . {comprising microcrystalline silicon}
 - 71/125 . {The active layers comprising only Group II-VI materials, e.g. CdS, ZnS or CdTe}
 - 71/1253 . . {comprising at least three elements, e.g. HgCdTe}
 - 71/1257 . . {comprising growth substrates not made of Group II-VI materials}
 - 71/127 . {The active layers comprising only Group III-V materials, e.g. GaAs or InP}
 - 71/1272 . . {comprising at least three elements, e.g. GaAlAs or InGaAsP}
 - 71/1274 . . . {comprising nitrides, e.g. InGaN or InGaIn}
 - 71/1276 . . {comprising growth substrates not made of Group III-V materials}
 - 71/1278 . . {comprising nitrides, e.g. GaN}
 - 71/128 . {Annealing}
 - WARNING**
 - Group [H10F 71/128](#) is incomplete pending reclassification of documents from groups [H10F 71/00](#) and [H10F 71/10](#).
 - Groups [H10F 71/00](#), [H10F 71/10](#) and [H10F 71/128](#) should be considered in order to perform a complete search.
 - 71/129 . {Passivating}
 - WARNING**
 - Group [H10F 71/129](#) is incomplete pending reclassification of documents from groups [H10F 71/00](#) and [H10F 71/10](#).
 - Groups [H10F 71/00](#), [H10F 71/10](#) and [H10F 71/129](#) should be considered in order to perform a complete search.
 - 71/131 . {Recrystallisation; Crystallization of amorphous or microcrystalline semiconductors}
 - WARNING**
 - Group [H10F 71/131](#) is incomplete pending reclassification of documents from groups [H10F 71/00](#) and [H10F 71/10](#).
 - Groups [H10F 71/00](#), [H10F 71/10](#) and [H10F 71/131](#) should be considered in order to perform a complete search.
- 71/132 . {Gettering}
 - WARNING**
 - Group [H10F 71/132](#) is incomplete pending reclassification of documents from groups [H10F 71/00](#) and [H10F 71/10](#).
 - Groups [H10F 71/00](#), [H10F 71/10](#) and [H10F 71/132](#) should be considered in order to perform a complete search.
- 71/133 . {Providing edge isolation}
 - WARNING**
 - Group [H10F 71/133](#) is incomplete pending reclassification of documents from groups [H10F 71/00](#) and [H10F 71/10](#).
 - Groups [H10F 71/00](#), [H10F 71/10](#) and [H10F 71/133](#) should be considered in order to perform a complete search.
- 71/134 . {Irradiation with electromagnetic or particle radiation}
 - WARNING**
 - Group [H10F 71/134](#) is incomplete pending reclassification of documents from group [H10F 71/00](#).
 - Groups [H10F 71/00](#) and [H10F 71/134](#) should be considered in order to perform a complete search.
- 71/135 . {Application of a bias; Current injection}
 - WARNING**
 - Group [H10F 71/135](#) is incomplete pending reclassification of documents from groups [H10F 71/00](#) and [H10F 71/10](#).
 - Groups [H10F 71/00](#), [H10F 71/10](#) and [H10F 71/135](#) should be considered in order to perform a complete search.
- 71/136 . {Singulating, e.g. dicing}
 - WARNING**
 - Group [H10F 71/136](#) is incomplete pending reclassification of documents from group [H10F 71/00](#).
 - Groups [H10F 71/00](#) and [H10F 71/136](#) should be considered in order to perform a complete search.
- 71/137 . {Batch treatment of the devices}
 - WARNING**
 - Groups [H10F 71/137](#) and [H10F 71/1375](#) are incomplete pending reclassification of documents from group [H10F 71/10](#).
 - Groups [H10F 71/10](#), [H10F 71/137](#) and [H10F 71/1375](#) should be considered in order to perform a complete search.
- 71/1375 . . {Apparatus for automatic interconnection of photovoltaic cells in a module}

- 71/138 . . {Manufacture of transparent electrodes, e.g. transparent conductive oxides [TCO] or indium tin oxide [ITO] electrodes}
- WARNING**
- Groups [H10F 71/138](#) and [H10F 71/1385](#) are incomplete pending reclassification of documents from group [H10F 71/10](#).
- Groups [H10F 71/10](#), [H10F 71/138](#) and [H10F 71/1385](#) should be considered in order to perform a complete search.
- 71/1385 . . {Etching transparent electrodes}
- 71/139 . . {using temporary substrates}
- WARNING**
- Groups [H10F 71/139](#) and [H10F 71/1395](#) are incomplete pending reclassification of documents from group [H10F 71/10](#).
- Groups [H10F 71/10](#), [H10F 71/139](#) and [H10F 71/1395](#) should be considered in order to perform a complete search.
- 71/1395 . . {for thin-film devices}
- 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)**
- NOTE**
- When classifying in this group, the type of device itself, when it is determined to be novel and nonobvious, should be classified in groups [H10F 10/00](#), [H10F 19/00](#), [H10F 30/00](#) or [H10F 55/00](#).
- 77/10 . . Semiconductor bodies
- 77/12 . . Active materials
- NOTE**
- 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
- 77/1215 {characterised by the dopants}
- 77/122 . . . comprising only Group IV materials
- 77/1223 characterised by the dopants
- 77/1226 comprising multiple Group IV elements, e.g. SiC
- 77/1227 {characterised by the dopants}
- 77/1228 {porous silicon}
- 77/123 . . . comprising only Group II-VI materials, e.g. CdS, ZnS or HgCdTe
- 77/1233 {characterised by the dopants}
- 77/1237 {having at least three elements, e.g. HgCdTe}
- 77/124 . . . comprising only Group III-V materials, e.g. GaAs
- 77/1243 {characterised by the dopants}
- 77/1246 {III-V nitrides, e.g. GaN}
- 77/1248 {having three or more elements, e.g. GaAlAs, InGaAs or InGaAsP}
- 77/12485 {comprising nitride compounds, e.g. InGaN}
- 77/126 . . . {comprising only Group I-III-VI chalcopyrite materials, e.g. CuInSe₂, CuGaSe₂ or CuInGaSe₂ [CIGS]}
- 77/1265 {characterised by the dopants}
- 77/127 {comprising only Group IV-VI or only Group II-IV-VI chalcogenide materials, e.g. PbSnTe}
- 77/1275 {characterised by the dopants}
- 77/128 {comprising only Group I-II-IV-VI kesterite materials, e.g. Cu₂ZnSnSe₄ or Cu₂ZnSnS₄}
- 77/1285 {characterised by the dopants}
- 77/14 . . Shape of semiconductor bodies; Shapes, relative sizes or dispositions of semiconductor regions within semiconductor bodies
- 77/143 {comprising quantum structures}
- 77/1433 {Quantum dots}
- 77/1437 {Quantum wires or nanorods}
- 77/146 {Superlattices; Multiple quantum well structures}
- 77/1462 {comprising amorphous semiconductor layers}
- 77/1465 {including only Group IV materials, e.g. Si-SiGe superlattices}
- 77/1468 {Doped superlattices, e.g. N-I-P-I superlattices}
- 77/147 {Shapes of bodies}
- 77/148 {Shapes of potential barriers}
- 77/16 . . Material structures, e.g. crystalline structures, film structures or crystal plane orientations
- 77/162 . . . Non-monocrystalline materials, e.g. semiconductor particles embedded in insulating materials ([H10F 77/169](#) takes precedence)
- 77/1625 {Semiconductor nanoparticles embedded in semiconductor matrix}
- 77/164 Polycrystalline semiconductors
- 77/1642 {including only Group IV materials}
- 77/1645 {including microcrystalline silicon}
- 77/1648 {including microcrystalline Group IV-IV materials, e.g. microcrystalline SiGe}
- 77/166 Amorphous semiconductors
- 77/1662 {including only Group IV materials}
- 77/1665 {including Group IV-IV materials, e.g. SiGe or SiC}
- 77/1668 {presenting light-induced characteristic variations, e.g. Staebler-Wronski effect}
- 77/169 . . . Thin semiconductor films on metallic or insulating substrates
- 77/1692 {the films including only Group IV materials}
- 77/1694 {the films including Group I-III-VI materials, e.g. CIS or CIGS}
- 77/1696 {the films including Group II-VI materials, e.g. CdTe or CdS}
- 77/1698 {the metallic or insulating substrates being flexible}
- 77/1699 {the films including Group I-III-VI materials, e.g. CIS or CIGS on metal foils or polymer foils}
- 77/20 . . Electrodes
- 77/206 . . . {for devices having potential barriers}
- 77/211 . . . {for photovoltaic cells}
- 77/215 {Geometries of grid contacts}

- 77/219 {Arrangements for electrodes of back-contact photovoltaic cells}
 - 77/223 {for metallisation wrap-through [MWT] photovoltaic cells}
 - 77/227 {for emitter wrap-through [EWT] photovoltaic cells, e.g. interdigitated emitter-base back-contacts}
 - 77/241 . . . {comprising ring electrodes}
 - 77/244 . . {made of transparent conductive layers, e.g. transparent conductive oxide [TCO] layers}
 - 77/247 . . . {comprising indium tin oxide [ITO]}
 - 77/251 . . . {comprising zinc oxide [ZnO]}
 - 77/254 . . . {comprising a metal, e.g. transparent gold}
 - 77/30 . . Coatings (arrangements for preventing damage to photovoltaic cells caused by corpuscular radiation [H10F 77/80](#))
 - 77/306 . . {for devices having potential barriers}
 - 77/311 . . . {for photovoltaic cells}
 - 77/315 {the coatings being antireflective or having enhancing optical properties}
 - 77/331 . . . {for filtering or shielding light, e.g. multicolour filters for photodetectors}
 - 77/334 {for shielding light, e.g. light blocking layers or cold shields for infrared detectors}
 - 77/337 {using interference filters, e.g. multilayer dielectric filters}
 - 77/40 . . Optical elements or arrangements ([surface textures H10F 77/70](#))
 - 77/407 . . {indirectly associated with the devices}
 - 77/413 . . {directly associated or integrated with the devices, e.g. back reflectors ([directly associated or integrated with photovoltaic cells H10F 77/42](#))}
 - 77/42 . . directly associated or integrated with photovoltaic cells, e.g. light-reflecting means or light-concentrating means
 - 77/45 . . . Wavelength conversion means, e.g. by using luminescent material, fluorescent concentrators or up-conversion arrangements
 - 77/48 . . . Back surface reflectors [BSR]
 - 77/484 . . . {Refractive light-concentrating means, e.g. lenses}
 - 77/488 . . . {Reflecting light-concentrating means, e.g. parabolic mirrors or concentrators using total internal reflection}
 - 77/492 . . . {Spectrum-splitting means, e.g. dichroic mirrors}
 - 77/496 . . {Luminescent members, e.g. fluorescent sheets ([wavelength conversion means for photovoltaic cells H10F 77/45](#))}
 - 77/50 . . Encapsulations or containers ([for photovoltaic modules H10F 19/80](#))
 - 77/60 . . Arrangements for cooling, heating, ventilating or compensating for temperature fluctuations
 - 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
 - 77/67 . . . including means to utilise heat energy directly associated with the photovoltaic cells, e.g. integrated Seebeck elements
 - 77/68 . . . {using gaseous or liquid coolants, e.g. air flow ventilation or water circulation}
 - 77/70 . . Surface textures, e.g. pyramid structures
 - 77/703 . . {of the semiconductor bodies, e.g. textured active layers}
 - 77/707 . . {of the substrates or of layers on substrates, e.g. textured ITO layer on a glass substrate}
 - 77/80 . . Arrangements for preventing damage to photovoltaic cells caused by corpuscular radiation, e.g. for space applications
 - 77/90 . . Energy storage means directly associated or integrated with photovoltaic cells, e.g. capacitors integrated with photovoltaic cells
 - 77/93 . . {Interconnections}
 - 77/933 . . {for devices having potential barriers}
 - 77/935 . . . {for photovoltaic devices or modules}
 - 77/937 {Busbar structures for modules}
 - 77/939 {Output lead wires or elements}
 - 77/95 . . {Circuit arrangements}
 - 77/953 . . {for devices having potential barriers}
 - 77/955 . . . {for photovoltaic devices}
 - 77/957 . . . {for position-sensitive photodetectors, e.g. lateral-effect photodiodes or quadrant photodiodes}
 - 77/959 . . . {for devices working in avalanche mode}
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- 99/00 Subject matter not provided for in other groups of this subclass**
- WARNING**
- Group [H10F 99/00](#) is impacted by reclassification into groups [H10F 10/00](#), [H10F 19/00](#), [H10F 30/00](#), [H10F 39/00](#) and [H10F 39/10](#).
- All groups listed in this Warning should be considered in order to perform a complete search.