

# 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 ( <a href="#">H10F 10/18</a> 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 <sub>2</sub> [CIS] heterojunction photovoltaic cells                                              |
| 10/142  | . . . comprising multiple PN homojunctions, e.g. tandem cells                                                 | 10/169 | . . . {comprising Cu <sub>2</sub> X/CdX heterojunctions, wherein X is a Group VI element, e.g. Cu <sub>2</sub> 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 <a href="#">H10F 30/00</a> 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 ( <a href="#">H10F 39/156</a> , <a href="#">H10F 39/157</a> 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}
<b>39/00</b>	<b>Integrated devices, or assemblies of multiple devices, comprising at least one element covered by group <a href="#">H10F 30/00</a>, e.g. radiation detectors comprising photodiode arrays</b>	39/159	. . . . . {comprising a photoconductive layer deposited on the CCD structure}
	<b>WARNING</b>	39/18	. . . Complementary metal-oxide-semiconductor [CMOS] image sensors; Photodiode array image sensors
	Groups <a href="#">H10F 39/00</a> and <a href="#">H10F 39/10</a> are incomplete pending reclassification of documents from group <a href="#">H10F 99/00</a> .	39/182	. . . . . {Colour image sensors}
	Groups <a href="#">H10F 99/00</a> , <a href="#">H10F 39/00</a> and <a href="#">H10F 39/10</a> 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 <a href="#">H10F 39/12</a> }	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 <a href="#">H10F 30/00</a> 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  
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 InGaAlN}
- 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. CuInSe<sub>2</sub>, CuGaSe<sub>2</sub> or CuInGaSe<sub>2</sub> [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. Cu<sub>2</sub>ZnSnSe<sub>4</sub> or Cu<sub>2</sub>ZnSnS<sub>4</sub>}
- 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]}

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| <ul style="list-style-type: none"> <li>77/251 . . . {comprising zinc oxide [ZnO]}</li> <li>77/254 . . . {comprising a metal, e.g. transparent gold}</li> <li>77/30 . Coatings (arrangements for preventing damage to photovoltaic cells caused by corpuscular radiation <a href="#">H10F 77/80</a>)</li> <li>77/306 . . {for devices having potential barriers}</li> <li>77/311 . . . {for photovoltaic cells}</li> <li>77/315 . . . . {the coatings being antireflective or having enhancing optical properties}</li> <li>77/331 . . . {for filtering or shielding light, e.g. multicolour filters for photodetectors}</li> <li>77/334 . . . . {for shielding light, e.g. light blocking layers or cold shields for infrared detectors}</li> <li>77/337 . . . . {using interference filters, e.g. multilayer dielectric filters}</li> <li>77/40 . Optical elements or arrangements (<a href="#">surface textures H10F 77/70</a>)</li> <li>77/407 . . {indirectly associated with the devices}</li> <li>77/413 . . {directly associated or integrated with the devices, e.g. back reflectors (directly associated or integrated with photovoltaic cells <a href="#">H10F 77/42</a>)}</li> <li>77/42 . . directly associated or integrated with photovoltaic cells, e.g. light-reflecting means or light-concentrating means</li> <li>77/45 . . . Wavelength conversion means, e.g. by using luminescent material, fluorescent concentrators or up-conversion arrangements</li> <li>77/48 . . . Back surface reflectors [BSR]</li> <li>77/484 . . . {Refractive light-concentrating means, e.g. lenses}</li> <li>77/488 . . . {Reflecting light-concentrating means, e.g. parabolic mirrors or concentrators using total internal reflection}</li> <li>77/492 . . . {Spectrum-splitting means, e.g. dichroic mirrors}</li> <li>77/496 . . {Luminescent members, e.g. fluorescent sheets (wavelength conversion means for photovoltaic cells <a href="#">H10F 77/45</a>)}</li> <li>77/50 . Encapsulations or containers (<a href="#">for photovoltaic modules H10F 19/80</a>)</li> <li>77/60 . Arrangements for cooling, heating, ventilating or compensating for temperature fluctuations</li> <li>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</li> <li>77/67 . . . including means to utilise heat energy directly associated with the photovoltaic cells, e.g. integrated Seebeck elements</li> <li>77/68 . . . {using gaseous or liquid coolants, e.g. air flow ventilation or water circulation}</li> <li>77/70 . Surface textures, e.g. pyramid structures</li> <li>77/703 . . {of the semiconductor bodies, e.g. textured active layers}</li> <li>77/707 . . {of the substrates or of layers on substrates, e.g. textured ITO layer on a glass substrate}</li> <li>77/80 . Arrangements for preventing damage to photovoltaic cells caused by corpuscular radiation, e.g. for space applications</li> <li>77/90 . Energy storage means directly associated or integrated with photovoltaic cells, e.g. capacitors integrated with photovoltaic cells</li> <li>77/93 . {Interconnections}</li> </ul> | <ul style="list-style-type: none"> <li>77/933 . . {for devices having potential barriers}</li> <li>77/935 . . . {for photovoltaic devices or modules}</li> <li>77/937 . . . . {Busbar structures for modules}</li> <li>77/939 . . . . {Output lead wires or elements}</li> <li>77/95 . {Circuit arrangements}</li> <li>77/953 . . {for devices having potential barriers}</li> <li>77/955 . . . {for photovoltaic devices}</li> <li>77/957 . . . {for position-sensitive photodetectors, e.g. lateral-effect photodiodes or quadrant photodiodes}</li> <li>77/959 . . . {for devices working in avalanche mode}</li> </ul> |
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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.