Semiconductor Sensors

Patent Landscape

August 2018

Introduction

A semiconductor sensor is a device that uses a semiconductor, usually silicon or germanium, to detect traversing charged particles or the absorption of photons. Several thin wafers of the semiconductor material are layered together to form these sensors. In the field of particle physics, these sensors are usually known as silicon detectors. When their sensitive structures are based on a single diode, they are called semiconductor diode detectors. When they contain many diodes with different functions, the more general term semiconductor detector is used. [1]

Semiconductor sensors are known for their higher detection efficiency, better spectrometric resolution, enhanced accuracy and low cost. There are different types of semiconductor sensors for determining gas pressure, temperature, voltage and radiation. The important application areas for semiconductor sensors include medical, automotive and aerospace. They have acquired an added importance in recent times due to the emergence of various applications under the umbrella of the "Internet of Things" (IoT).

The patents studied in this report cover semiconductor sensors and their applications. We analyzed a total of 25,667 currently active published patent applications for the study, of which 16,587 are granted. Unless otherwise stated, the report displays numbers for published patent applications. The analytics are presented in the various charts and tables that follow. These include the following,

- Published Applications – Summary
- Published Applications – Growth
- Top Patent Holders
- Top Patent Holders - Analysis
- Top Patent Holders – Portfolio Similarity
- Published Applications – By Jurisdiction
- Top CPC Codes
- Top Patent Holders – Portfolio Growth

- Top Patent Holders – Assets by Jurisdiction
- Top Jurisdictions – Growth
- Top CPC Codes – Growth
- Top Patent Holders – Patent Quality
- Key Technologies - Analysis
- Application Areas – Top Patent Holders
- Taxonomy
- Taxonomy (Tabular)

Insights

- The published patent applications in semiconductor sensors have shown a steady upward trend.
- The US leads as the jurisdiction with the largest number of published patent applications. The combined published patents in China-Japan-Taiwan-Korea account for around half of all the published applications in this area.
- Most of the leading patent holders have followed the policy of filing in the U.S. in addition to their home countries, indicating the importance of the U.S. market.
- Among the top patent holders - the portfolios of Sony, Samsung and TSMC have shown the most significant growth in recent years in the 2015-2017 period.

References

1. Semiconductor detector (Wikitronics)
2. Semiconductor detector (Wikipedia)
3. Semiconductor sensors [PDF] (Hall.G)

Published Applications - Summary

TOTAL DOCUMENTS COUNT (Applications)

25,667

PUBLICATION TYPES

8,712 | 16,587

● Applications ● Grants

Peak Year of Activity
2017 (3,190)

Top Active Jurisdiction
US (9,009)

IP TYPES

24,685 | 950

● Invention ● Model

Top Patent Holder SONY (1,011)

No of technologies 339

Top Rated
US8773336B2 (5)

Top Cited
US7453065B2 (2,782)

PATENT BY STAR RATING

2.17

★★★★★ 40
★★★★ 362
★★★ 5,782
★★ 17,110
★ 2,373

Published Applications - Growth
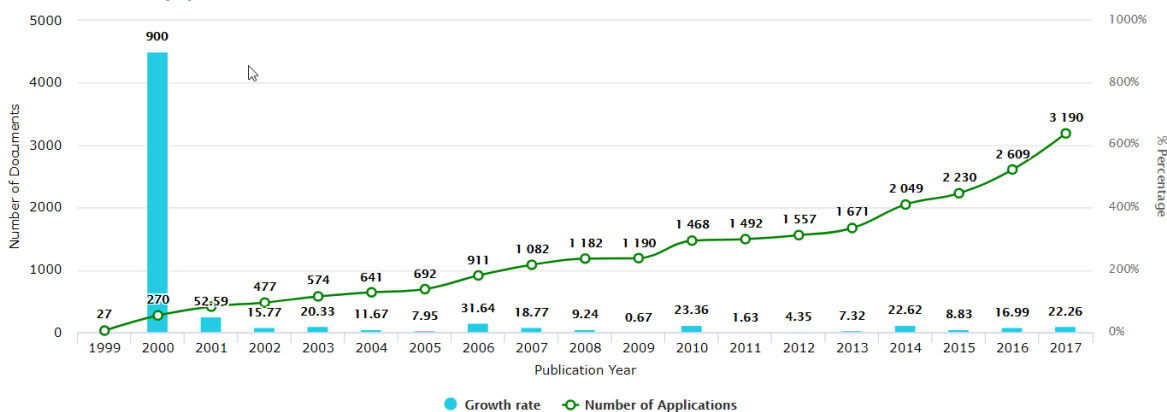
Published Applications - Top 20 Patent Holders

Ultimate Patent Holder	# Applications	Ultimate Patent Holder	# Applications
SONY	1,011	STMICROELECTRONICS	412
SAMSUNG	836	INFINEON	368
TAIWAN SEMICONDUCTOR (TSMC)	750	TOSHIBA	336
PANASONIC	712	PHILIPS	284
OMNIVISION TECHNOLOGIES	594	SHARP	273
FUJIFILM	584	SIEMENS	260
DENSO	556	MITSUBISHI	247
HITACHI	497	APTINA IMAGING	226
CANON	451	GE	226
BOSCH	436	AZBIL	225

Top Patent Holders - Analysis

Patent Holders	Applications	Grants	Technologies	Sub Technologies	Geographies
SONY	558	436	electric elements - semiconductor devices (987) , pictorial communication (778) , optical elements (103) , coders & decoders (37) , photography - camera (31)	multiple semiconductor or solid state devices components formed on a common substrate (967) , hardware or software aspects of tv signals (754) , semiconductor devices sensitive to infra-red, light, electromagnetic or corpuscular radiation, converting radiaiton into electrical energy (213) , connecting/disconnecting semiconductor bodies (189) , manufacturing or treatment of ics and semiconductor devices (180)	JP (468) , US (239) , CN (127) , KR (67) , TW (48)
SAMSUNG	289	532	electric elements - semiconductor devices (758) , pictorial communication (335) , optical elements (47) , digital data processing (32) , measurement by radio waves (32)	multiple semiconductor or solid state devices components formed on a common substrate (673) , hardware or software aspects of tv signals (319) , semiconductor devices sensitive to infra-red, light, electromagnetic or corpuscular radiation, converting radiaiton into electrical energy (237) , connecting/disconnecting semiconductor bodies (169) , manufacturing or treatment of ics and semiconductor devices (142)	US (350) , KR (273) , CN (74) , JP (73) , EP (29)
TAIWAN SEMICONDUCTOR (TSMC)	150	600	electric elements - semiconductor devices (735) , pictorial communication (65) , mems manufacturing (60) , mems devices (55) , greentech - reduction & transmission of greenhouse gases (27)	multiple semiconductor or solid state devices components formed on a common substrate (666) , manufacturing or treatment of ics and semiconductor devices (281) , semiconductor devices sensitive to infra-red, light, electromagnetic or corpuscular radiation, converting radiaiton into electrical energy (222) , connecting/disconnecting semiconductor bodies (189) , details of semiconductor devices (130)	US (397) , CN (158) , TW (110) , KR (54) , JP (16)
PANASONIC	432	164	electric elements - semiconductor devices (518) , pictorial communication (194) , measurement - speed (190) , measurement - pressure (122) , mems devices (53)	multiple semiconductor or solid state devices components formed on a common substrate (246) , multistep manufacturing process for rectifiers, oscillators, capacitors and resistors (212) , measuring acceleration, deceleration, shock (189) , hardware or software aspects of tv signals (176) , measuring fluid pressure by electric or magnetic pressure-sensitive elements (118)	JP (460) , US (64) , EP (36) , CN (23) , TW (9)
OMNIVISION TECHNOLOGIES	124	450	electric elements - semiconductor devices (574) , pictorial communication (223) , optical elements (35) , photography - camera (16) , digital data processing (10)	multiple semiconductor or solid state devices components formed on a common substrate (570) , hardware or software aspects of tv signals (218) , semiconductor devices sensitive to infra-red, light, electromagnetic or corpuscular radiation, converting radiaiton into electrical energy (129) , connecting/disconnecting semiconductor bodies (78) , manufacturing or treatment of ics and semiconductor devices (68)	US (182) , CN (165) , TW (139) , EP (73) , JP (15)

Topic Map – Top Patent Holders – Portfolio Similarity

- The bubble size corresponds to the total number of patent applications held.
- The bubble proximity corresponds to the similarity of each of the company portfolios in terms of technologies covered.

Published Applications - By Jurisdiction

Others: 598
RU: 119
WO: 185
DE: 729
TW: 1,330
KR: 1,397
EP: 1,966
CN: 5,086
JP: 5,248
US: 9,009
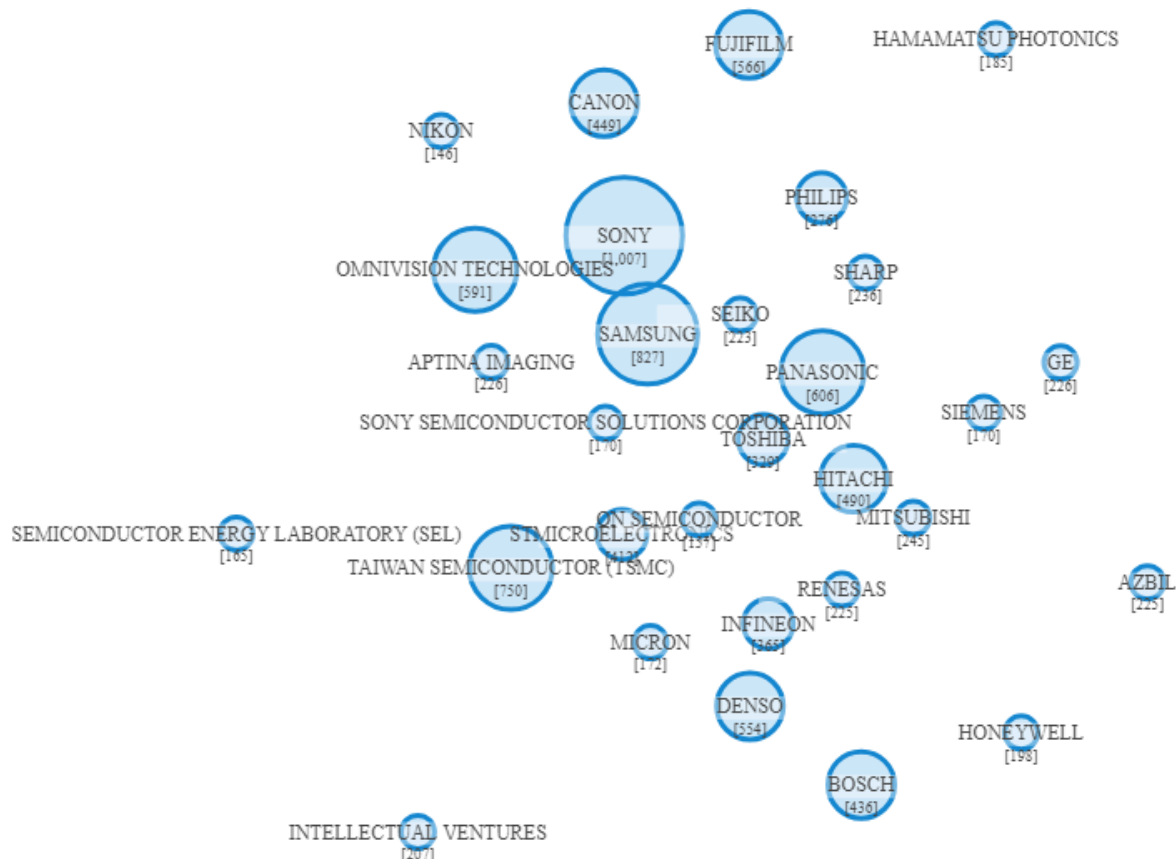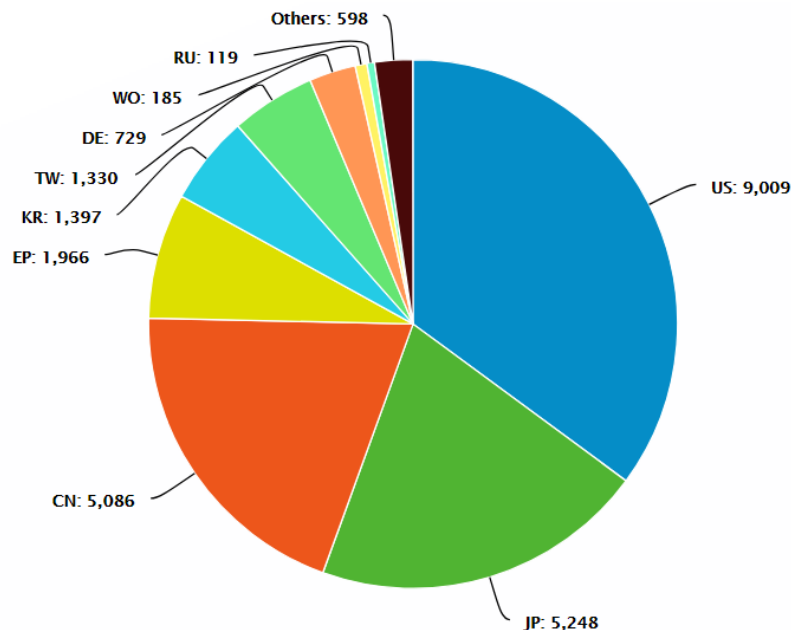
Published Applications - Top 20 CPC Codes

Class Code	Description	# Applications
H01L 27/14	Multiple semiconductor or solid state devices components formed on a common substrate >> including semiconductor components sensitive to infra-red radiation, light, electromagnetic radiation of shorter wavelength, or corpuscular radiation and specially adapted either for the conversion of the energy of such radiation into electrical energy or for the control of electrical energy by such radiation	7,763
H01L 2224/01	Connecting/disconnecting semiconductor bodies >> Means for bonding being attached to, or being formed on, the surface to be connected, e.g. chip-to-package, die-attach, "first-level" interconnects; Manufacturing methods related thereto	4,965
H04N 5/30	Hardware or software aspects of TV signals >> Transforming light or analogous information into electric information	2,627
H01L 2924/10	Connecting/disconnecting semiconductor bodies >> Details of semiconductor or other solid state devices to be connected	2,447
H01L 2924/15	Connecting/disconnecting semiconductor bodies >> Details of package parts other than the semiconductor or other solid state devices to be connected	2,390
H01L 2224/73	Connecting/disconnecting semiconductor bodies >> Means for bonding being of different types provided for in two or more of groups	2,139

Class Code	Description	# Applications
H01L 2924/0001	Connecting/disconnecting semiconductor bodies >> Technical content checked by a classifier	1,750
H01L 24/01	Connecting/disconnecting semiconductor bodies >> Means for bonding being attached to, or being formed on, the surface to be connected, e.g. chip-to-package, die-attach, "first-level" interconnects; Manufacturing methods related thereto	1,627
G01T 1/16	Measuring and detecting X-radiation, gamma, corpuscular, cosmic, or neutron radiation >> Measuring radiation intensity	1,552
H01L 31/02	Semiconductor devices sensitive to infra-red, light, electromagnetic or corpuscular radiation, converting radiation into electrical energy >> Details	1,397
G01L 9/0041	Measuring fluid pressure by electric or magnetic pressure-sensitive elements >> Transmitting or indicating the displacement of flexible diaphragms	1,212
H01L 2924/01	Connecting/disconnecting semiconductor bodies >> Chemical elements	1,087
G01P 15/02	Measuring acceleration, deceleration, shock >> by making use of inertia forces ; using solid seismic masses	1,040
H01L 2224/80	Connecting/disconnecting semiconductor bodies >> Methods for connecting semiconductor or other solid state bodies using means for bonding being attached to, or being formed on, the surface to be connected	1,038
H01L 21/02	Manufacturing or treatment of ICs and semiconductor devices >> Manufacture or treatment of semiconductor devices or of parts thereof	994
H04N 5/222	Hardware or software aspects of TV signals >> Studio circuitry; Studio devices; Studio equipment ; ; Cameras comprising an electronic image sensor, e.g. digital cameras, video cameras, TV cameras, video cameras, camcorders, webcams, camera modules for embedding in other devices, e.g. mobile phones, computers or vehicles	977
H01L 31/08	Semiconductor devices sensitive to infra-red, light, electromagnetic or corpuscular radiation, converting radiation into electrical energy >> in which radiation controls flow of current through the device, e.g. photoresistors	956
B81B 2201/02	Specific applications of micro-electromechanical systems >> Sensors	942
H01L 2924/30	Connecting/disconnecting semiconductor bodies >> Technical effects	929
B81C 1/00015	Manufacture or treatment of micro-structures on or in substrate >> for manufacturing microsystems	903

Published Applications – Top 10 Patent Holders – Portfolio Growth

Ultimate Patent Holder	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
BOSCH	0	1	2	4	11	8	13	14	13	13	15	32	30	34	37	40	54	35	49	31
CANON	1	9	12	38	13	17	24	25	21	13	12	12	20	23	22	44	42	38	46	17
HITACHI	1	9	11	9	25	16	16	25	36	37	27	26	28	31	17	50	38	28	34	33
DENSO	1	3	11	17	13	22	23	24	35	37	43	43	37	40	36	37	41	31	39	21
FUJIFILM	1	14	7	7	15	15	25	53	67	36	53	45	61	42	21	40	36	26	13	6
OMNIVISION TECHNOLOGIES	2	2	7	12	7	10	14	21	27	19	23	24	30	27	52	62	62	79	68	45
PANASONIC	1	43	34	31	21	28	29	47	46	58	45	73	60	44	33	41	21	24	23	8
TAIWAN SEMICONDUCTOR (TSMC)	0	3	8	11	9	8	3	5	11	20	21	18	23	23	49	79	83	149	160	67
SAMSUNG	0	1	5	1	1	5	14	34	51	47	48	47	34	42	53	54	95	120	114	66
SONY	0	13	29	24	32	27	21	30	18	36	45	36	61	49	60	50	105	115	164	92

Published Year

Published Applications – Top 10 Patent Holders – Assets by Jurisdiction

Jurisdiction	SONY	SAMSUNG	TAIWAN SEMICONDUCTOR (TSMC)	PANASONIC	OMNIVISION TECHNOLOGIES	FUJIFILM	DENSO	HITACHI	CANON	BOSCH
GB	0	0							2	3
WO	10			1			3	1	1	1
FR							11			7
DE	5	8	13	9	6	3	65	7	2	108
TW	48	20	110	11	139	16		6	5	12
EP	42	29	2	42	73	26	8	76	22	63
KR	67	274	54	4	12	8	2	8	3	16
CN	127	75	158	31	165	21	24	41	45	68
US	239	352	397	75	183	59	168	155	124	123
JP	468	73	16	535	15	447	273	201	236	26

Ultimate Patent Holder
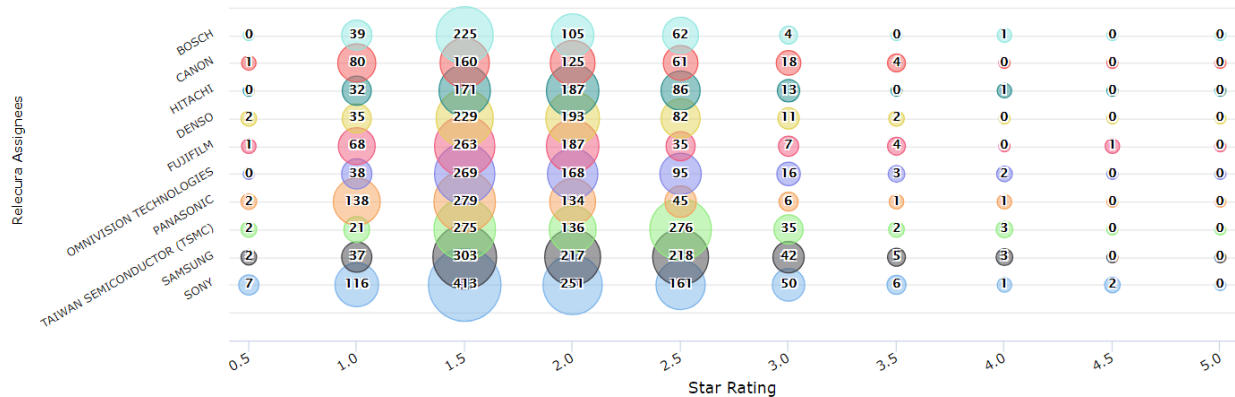
Published Applications – Top 10 Jurisdictions - Growth
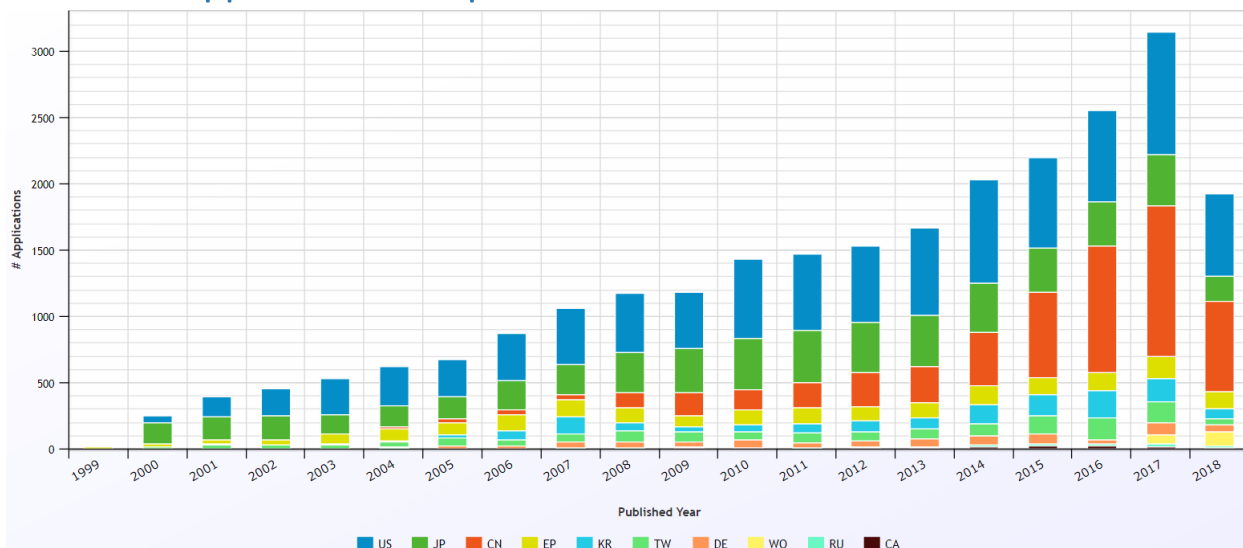
Published Applications – Top 10 CPC Codes – Growth
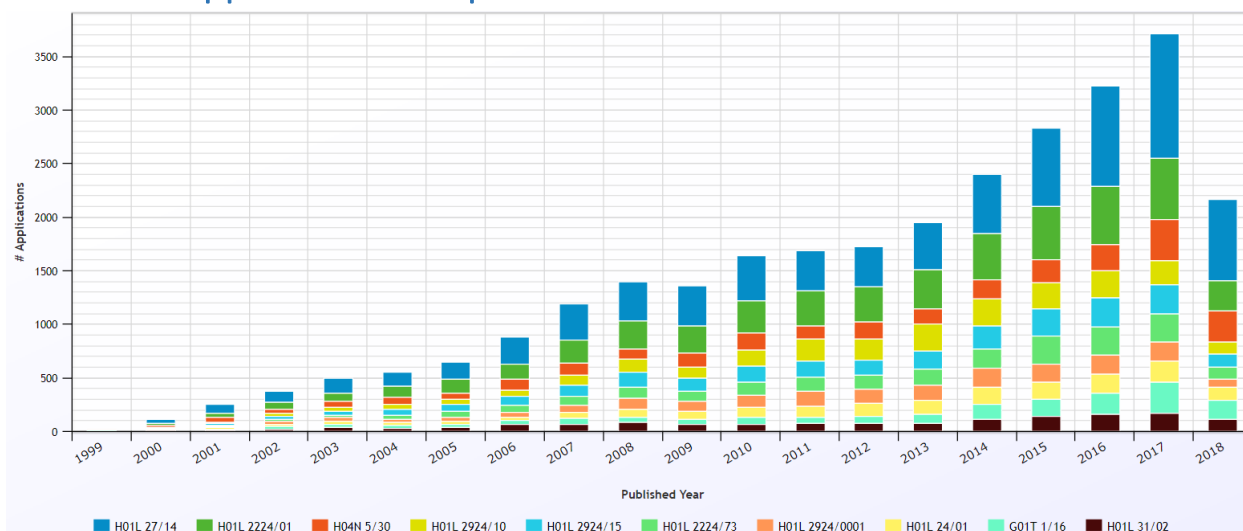
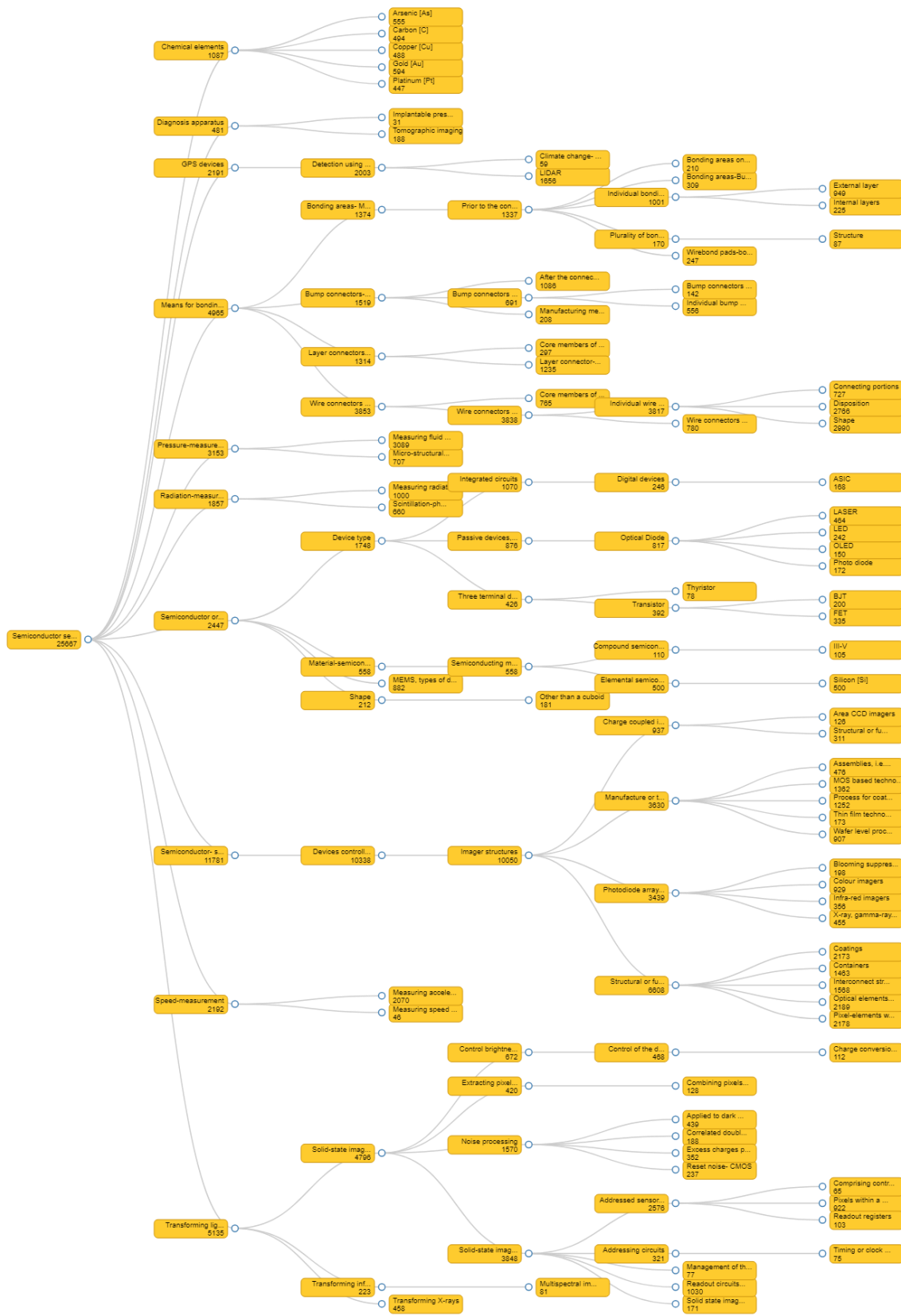## Patent Quality – Top 10 Patent Holders *(Relecura Star Rating on a scale of 5)*

Relecura Assignees	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
BOSCH	0	39	225	105	62	4	0	1	0	0
CANON	1	80	160	125	61	18	4	0	0	0
HITACHI	0	32	171	187	86	13	0	1	0	0
DENSO	2	35	229	193	82	11	2	0	0	0
FUJIFILM	1	68	263	187	35	7	4	0	1	0
OMNIVISION TECHNOLOGIES	0	38	269	168	95	16	3	2	0	0
PANASONIC	2	138	279	134	45	6	1	1	0	0
TAIWAN SEMICONDUCTOR (TSMC)	2	21	275	136	276	35	2	3	0	0
SAMSUNG	2	37	303	217	218	42	5	3	0	0
SONY	7	116	413	251	161	50	6	1	2	0

Star Rating

Key Technologies - Analysis

Technologies	Applications	Grants	Patent Holders	Sub Technologies	Geographies
electric elements - semiconductor devices	6118	11488	SONY (987) , SAMSUNG (758) , TAIWAN SEMICONDUCTOR (TSMC) (735) , OMNIVISION TECHNOLOGIES (574) , PANASONIC (518)	multiple semiconductor or solid state devices components formed on a common substrate (12289) , connecting/disconnecting semiconductor bodies (5988) , hardware or software aspects of tv signals (5040) , semiconductor devices sensitive to infra-red, light, electromagnetic or corpuscular radiation, converting radiaiton into electrical energy (4575) , manufacturing or treatment of ics and semiconductor devices (4058)	US (6045) , JP (4265) , CN (2981) , EP (1265) , TW (1252)
pictorial communication	2239	3651	SONY (778) , FUJIFILM (351) , SAMSUNG (335) , CANON (310) , OMNIVISION TECHNOLOGIES (224)	hardware or software aspects of tv signals (5588) , multiple semiconductor or solid state devices components formed on a common substrate (5221) , semiconductor devices sensitive to infra-red, light, electromagnetic or corpuscular radiation, converting radiaiton into electrical energy (1402) , connecting/disconnecting semiconductor bodies (775) , colour tv details (702)	JP (2055) , US (1976) , CN (659) , EP (381) , KR (338)
measurement - pressure	1123	1981	DENSO (272) , BOSCH (162) , AZBIL (139) , PANASONIC (122) , INFINEON (109)	measuring fluid pressure by electric or magnetic pressure-sensitive elements (2758) , details, accessories, apparatus for measuring pressure of fluent medium (1169) , multistep manufacturing process for rectifiers, oscillators, capacitors and resistors (949) , connecting/disconnecting semiconductor bodies (559) , measuring force or stress (525)	US (842) , CN (774) , JP (772) , EP (290) , DE (178)
measurement - radiation	1098	1857	PHILIPS (204) , GE (188) , HITACHI (181) , FUJIFILM (133) , SIEMENS (124)	measuring and detecting x-radiation, gamma, corpuscular, cosmic, or neutron radiation (2991) , multiple semiconductor or solid state devices components formed on a common substrate (807) , semiconductor devices sensitive to infra-red, light, electromagnetic or corpuscular radiation, converting radiaiton into electrical energy (723) , radiation diagnosis apparatus (650) , hardware or software aspects of tv signals (447)	US (896) , JP (729) , CN (474) , EP (433) , KR (114)
measurement by radio waves	958	1184	AZBIL (84) , BOSCH (56) , HAMAMATSU PHOTONICS (42) , CONTINENTAL (41) , AUDI (40)	detecting the presence, distance or velocity of object using reflection or reradiation of em waves (1575) , details of the systems using reflection or reradiation of waves (1348) , detecting the presence, distance or velocity of object using reflection or reradiation of radio waves (415) , measuring distances in line of sight and optical rangefinders (267) , measurements using optics between ir and uv (245)	CN (771) , US (547) , JP (251) , EP (235) , DE (130)

Application Areas – Top Patent Holders

Areas	# Applications	Top patent holders (# Applications)
Medical	1562	PHILIPS (134) GE (123) SIEMENS (103) HITACHI (74) TOSHIBA (54)
Automotive	926	BOSCH (53) PORSCHE (42) CONTINENTAL (34) DENSO (34) HITACHI (20)
Aerospace	266	CONTINENTAL (8) IMAGE INSIGHT INC (8) BOEING (7) HONEYWELL (5) ZHEJIANG UNIVERSITY OF TECHNOLOGY (5)
Robots	122	BASF (7) TRINAMIX GMBH (7) NDSU RES FOUNDATION (4) BENEWAKE (BEIJING) PHOTONIC TECH CO LTD (3) CONTINENTAL (3)
Military & Defense	106	IMAGE INSIGHT INC (7) LOCKHEED MARTIN (6) ZHEJIANG UNIVERSITY OF TECHNOLOGY (5) AIRBUS (3) BOEING (3)

Relecura

Taxonomy – *showing published applications in each category*

Semiconductor se... 25667

Chemical elements 1087
- Arsenic [As] 555
- Carbon [C] 494
- Copper [Cu] 488
- Gold [Au] 594
- Platinum [Pt] 447

Diagnosis apparatus 481
- Implantable pres... 31
- Tomographic imaging 188

GPS devices 2191
- Detection using ... 2003
  - Climate change-... 59
  - LiDAR 1656

Means for bondin... 4965
- Bonding areas- M... 1374
  - Prior to the con... 1337
    - Bonding areas on... 210
    - Bonding areas-Bu... 309
    - Individual bondi... 1001
      - External layer 949
      - Internal layers 225
    - Plurality of bon... 170
      - Structure 87
    - Wirebond pads-bo... 247
- Bump connectors- 1519
  - Bump connectors ... 691
    - After the connec... 1086
      - Bump connectors ... 142
      - Individual bump ... 556
    - Manufacturing me... 208
- Layer connectors... 1314
  - Core members of ... 297
  - Layer connector-... 1235
- Wire connectors ... 3853
  - Wire connectors ... 3838
    - Core members of ... 765
    - Individual wire ... 3817
      - Connecting portions 727
      - Disposition 2766
      - Shape 2990
    - Wire connectors ... 780

Pressure-measure... 3153
- Measuring fluid ... 3089
- Micro-structural... 707

Radiation-measur. 1857
- Measuring radiat... 1000
- Scintillation-ph... 660

Device type 1748
- Integrated circuits 1070
  - Digital devices 246
    - ASIC 168
- Passive devices... 876
  - Optical Diode 817
    - LASER 464
    - LED 242
    - OLED 150
    - Photo diode 172
- Three terminal d... 426
  - Thyristor 78
  - Transistor 392
    - BJT 200
    - FET 335

Semiconductor or... 2447

Material-semicon... 558
- Semiconducting m... 558
  - Compound semicon... 110
    - III-V 105
  - Elemental semico... 500
    - Silicon [Si] 500
- MEMS, types of d... 882
- Shape 212
  - Other than a cuboid 181

Semiconductor- s... 11781
- Devices controll... 10338
  - Imager structures 10050
    - Charge coupled i... 937
      - Area CCD imagers 126
      - Structural or fu... 311
    - Manufacture or t... 3830
      - Assemblies, i.e... 476
      - MOS based techno... 1362
      - Process for coat... 1252
      - Thin film techno... 173
      - Wafer level proc... 907
    - Photodiode array... 3439
      - Blooming suppres... 198
      - Colour imagers 929
      - Infra-red imagers 356
      - X-ray, gamma-ray... 455
    - Structural or fu... 6608
      - Coatings 2173
      - Containers 1463
      - Interconnect str... 1568
      - Optical elements... 2189
      - Pixel-elements w... 2178

Speed-measurement 2192
- Measuring accele... 2070
- Measuring speed ... 46

Transforming lig... 5135

- Control brightne... 672
  - Control of the d... 468
    - Charge conversio... 112
- Extracting pixel... 420
  - Combining pixels... 128
- Solid-state imag... 4796
  - Noise processing 1570
    - Applied to dark ... 439
    - Correlated doubl... 188
    - Excess charges p... 352
    - Reset noise- CMOS 237
  - Solid-state imag... 3848
    - Addressed sensor... 2576
      - Comprising contr... 65
      - Pixels within a ... 922
      - Readout registers 103
    - Addressing circuits 321
      - Timing or clock ... 75
    - Multispectral im... 81
      - Management of th... 77
      - Readout circuits... 1030
      - Solid state imag... 171
- Transforming inf... 223
  - Transforming X-rays 458

Taxonomy (Tabular-1)

Semiconductor Sensors	Chemical elements	Arsenic [As]		
		Carbon [C]		
		Copper [Cu]		
		Gold [Au]		
		Platinum [Pt]		
	Diagnosis apparatus	Implantable pressure measuring sensor		
		Tomographic imaging		
	GPS devices	Detection using reflection or reradiation of EM waves	Climate change- LIDAR system	
			LIDAR	
	Means for bonding - chip-to-package, die-attach	Bonding areas- Manufacturing methods	Prior to the connecting process - structure, shape, material or disposition of bonding areas	Bonding areas on chip-scale packages
				Bonding areas-Bump connectors
				Individual bonding area → External layer
				Individual bonding area → Internal layers
				Plurality of bonding areas → Structure
				Wirebond pads-bonding areas
		Bump connectors- manufacturing methods	After the connecting process, structure, shape, material or disposition of the bump connectors	
			Bump connectors prior to the connecting process - structure, shape, material or disposition of the	Bump connectors formed on an encapsulation of the semiconductor or solid-state body
				Individual bump connector
		Layer connectors - manufacturing methods	Manufacturing methods	
			Core members of the layer connector	
			Layer connector-Disposition	
		Wire connectors - manufacturing methods	Core members of the connector	
			Wire connectors after the connecting process - structure, shape, material or disposition	Individual wire connector → Connecting portions
				Individual wire connector → Disposition
				Individual wire connector → Shape
				Wire connectors Disposition
	Pressure-measurement	Measuring fluid pressure by electric or magnetic pressure-sensitive elements		
		Micro-structural systems		
	Radiation-measuring and detecting	Measuring radiation intensity with semiconductor detectors		
		Scintillation-photodiode combination		
	Semiconductor or other solid state devices to be connected	Device type	Integrated circuits	Digital devices → ASIC
			Passive devices, e.g. 2 terminal devices	Optical Diode → LASER
				Optical Diode → LED
				Optical Diode → OLED
				Optical Diode → Photo diode
			Three terminal devices	Thyristor
				Transistor → BJT
				Transistor → FET
		MEMS, types of devices		
		Material-semiconductor or solid state bodies	Semiconducting materials	Compound semiconductors → III-V
				Elemental semiconductors, i.e. Group IV → Silicon [Si]
		Shape	Other than a cuboid	

Taxonomy (Tabular-2)

Semiconductor sensors					
Semiconductor-sensitive to infra-red radiation & short wavelength	Devices controlled by radiation	Imager structures	Charge coupled imagers	Area CCD imagers	
				Structural or functional details thereof	
			Manufacture or treatment	Assemblies, i.e. hybrid integration	
				MOS based technologies	
				Process for coatings or optical elements	
				Thin film technologies, e.g. amorphous, poly, micro- or nanocrystalline silicon	
				Wafer level processing	
			Photodiode arrays; MOS imagers	Blooming suppression	
				Colour imagers	
				Infra-red imagers	
				X-ray, gamma-ray or corpuscular radiation imagers	
			Structural or functional details thereof	Coatings	
				Containers	
				Interconnect structures	
				Optical elements or arrangements associated with the device	
				Pixel-elements with integrated switching, control, storage or amplification elements	
Speed-measurement	Measuring acceleration, deceleration, shock				
	Measuring speed by using gyroscopic effect				
Transforming light or analogous information into electric information	Solid-state image sensors	Control brightness or motion in the scene	Control of the dynamic range	Charge conversion ratio	
		Extracting pixel data from an image sensor	Combining pixels - Solid-state image sensors		
		Noise processing	Applied to dark current		
			Correlated double or triple sampling		
			Excess charges produced by the exposure		
			Reset noise-CMOS		
		Solid-state image sensors architecture & circuits	Addressed sensors, e.g. MOS or CMOS sensors	Comprising control or output lines sharing a plurality of functions, e.g. output or driving or reset or power lines	
				Pixels within a sensor matrix, e.g. memories	
				Readout registers	
			Addressing circuits	Timing or clock signal generating circuits	
			Management of the power supply		
			Readout circuits-A/D converters		
			Solid state image sensors-display pixels		
	Transforming X-rays				
	Transforming infra-red radiation	Multispectral imaging-infrared region			

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About Relecura

Relecura is a full-stack cognitive cloud platform that provides custom intelligence and reports on patent portfolios, technologies and companies. It does this by capturing and organizing the knowledge from various document repositories (patents, scientific literature) and subject matter experts in a flexible and collaborative manner, into a knowledge-base.

Relecura offers IP analytics tools and a custom enterprise platform to corporations, law firms, IP services firms, R&D organizations and academic institutions. The enterprise platform integrates the discovery and analysis of public documents with internal company documents. Relecura also has an API to help create custom tools for IP and business intelligence. For more details visit www.relecura.com.

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