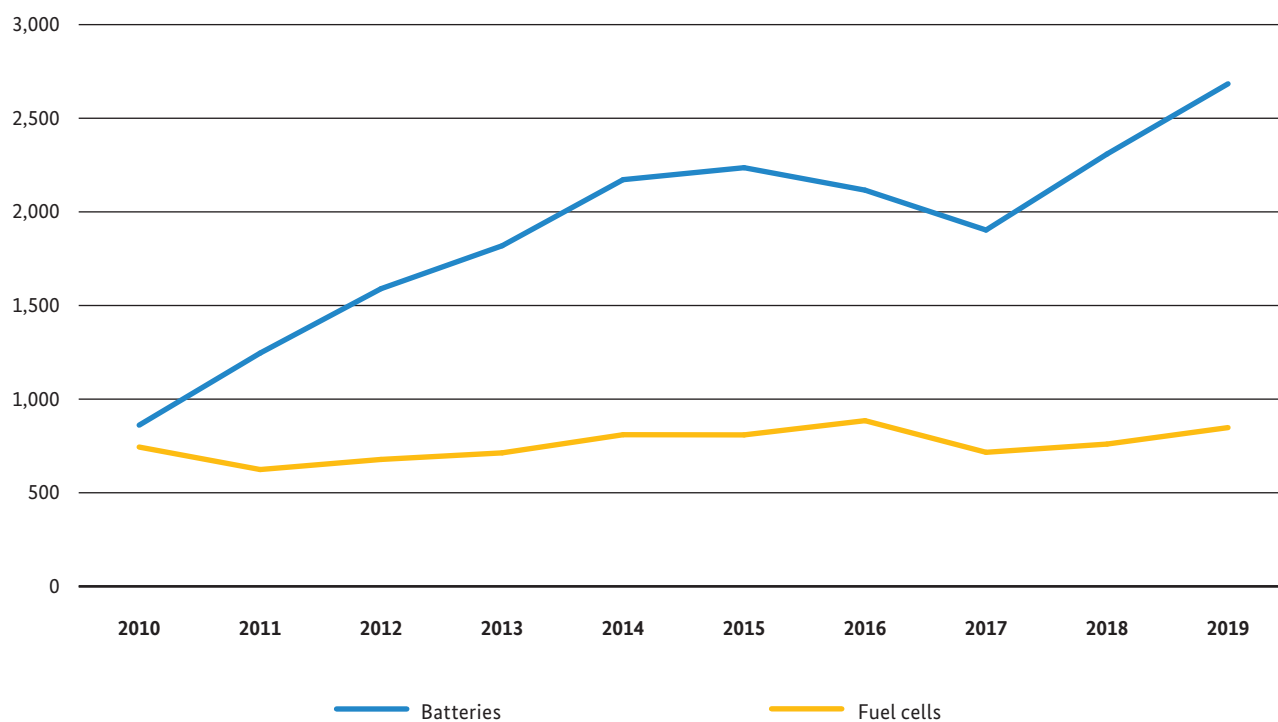




## Patent applications concerning batteries and fuel cells with effect in Germany



## Development of the patent applications effective in Germany<sup>1)</sup>: Batteries and fuel cells

	IPC <sup>2)</sup>	Year of publication									
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Batteries	H01M 2 H01M 4/02 H01M 4/04 H01M 4/13 – H01M 4/84 H01M 10	861	1,246	1,590	1,819	2,172	2,236	2,116	1,903	2,309	2,684
Fuel cells	H01M 4/86 – H01M 4/98 H01M 8	744	624	678	713	810	809	885	716	760	848

<sup>1)</sup> Applications published by the DPMA and the EPO, avoiding double counting.

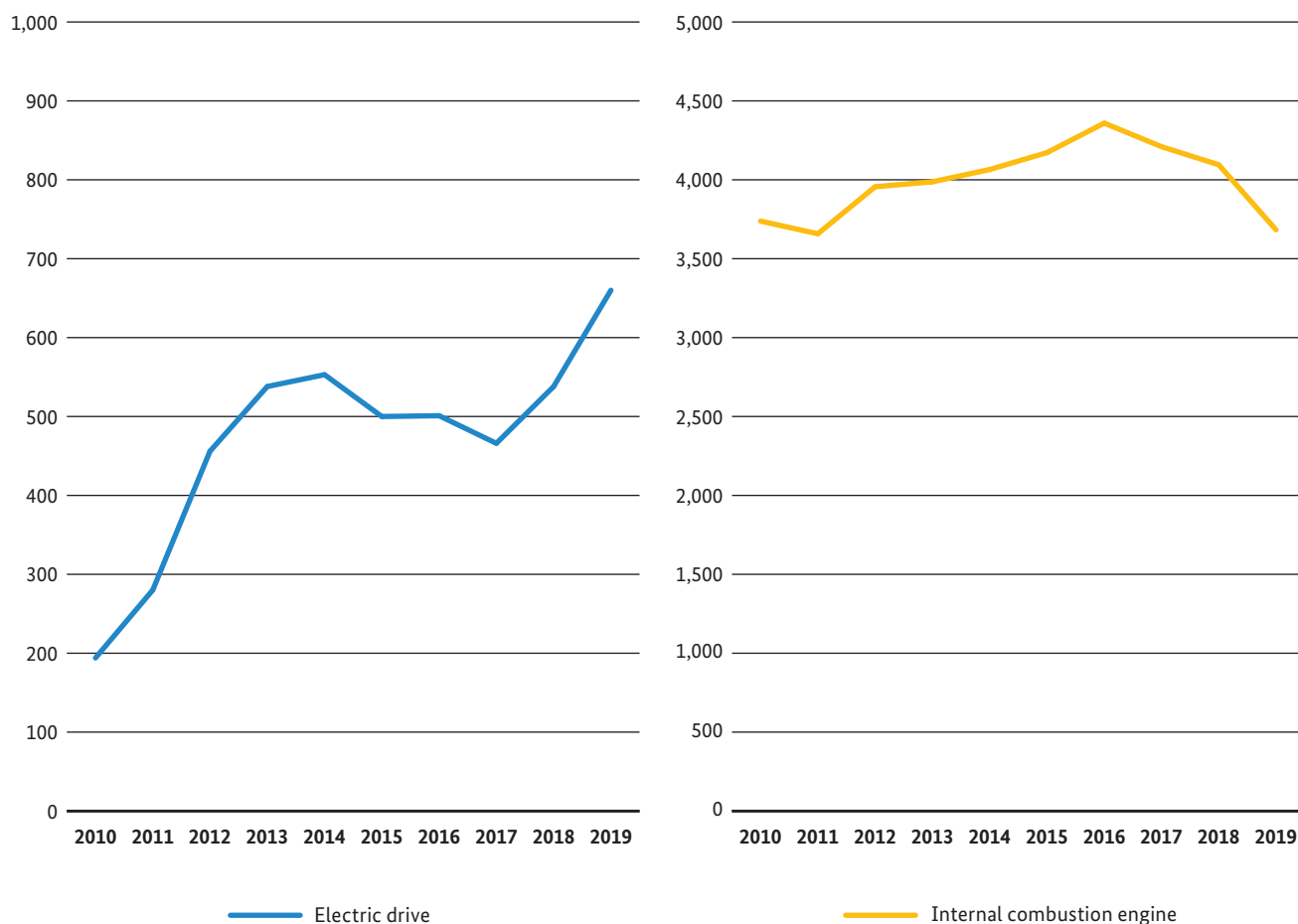
<sup>2)</sup> IPC classes valid at the time of information retrieval are counted proportionately; not exhaustive; results do not relate solely to vehicle drive technologies.



# Vehicle drive technologies

(as of February 2020)

Patent applications concerning electric drive and internal combustion engine with effect in Germany



Development of the patent applications effective in Germany<sup>1)</sup>: Electric drive and internal combustion engine

	IPC <sup>2)</sup>	Year of publication									
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Electric drive	B60L 7/12 B60L 7/14 B60L 8 B60L 11 B60L 50 B60L 58 B60L 15/00 – B60L 15/38 B60K 1	194	280	456	538	553	500	501	466	538	660
Internal combustion engine	F01N 3 F01N 5 F01N 9 F01N 11 F01L 1 F02B F02D F02F F02M F02N F02P F16C 3/18 F16C 3/20 F16F 15/24 F16F 15/31	3,738	3,658	3,956	3,987	4,065	4,172	4,359	4,210	4,095	3,683

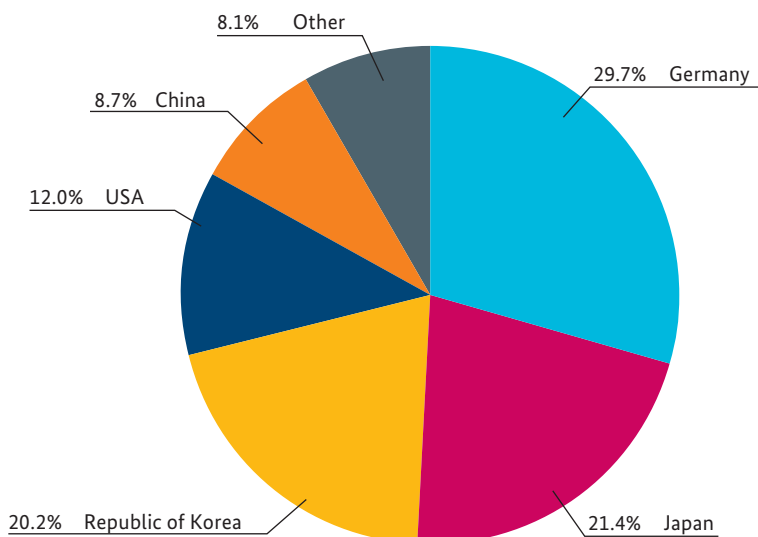
<sup>1)</sup> Applications published by the DPMA and the EPO, avoiding double counting.

<sup>2)</sup> IPC classes valid at the time of information retrieval are counted proportionately; not exhaustive; results not related to vehicle drive technologies may be included.

## Batteries

Patent applications with effect in Germany<sup>1)</sup> by country (residence or principal place of business of the applicant indicated first)

Country	Publication in 2019	
	Number	Percentage
Germany	796	29.7%
Japan	574	21.4%
Republic of Korea	541	20.2%
USA	322	12.0%
China	233	8.7%
Other	217	8.1%
<b>Total<sup>2)</sup></b>	<b>2,684</b>	<b>100%</b>



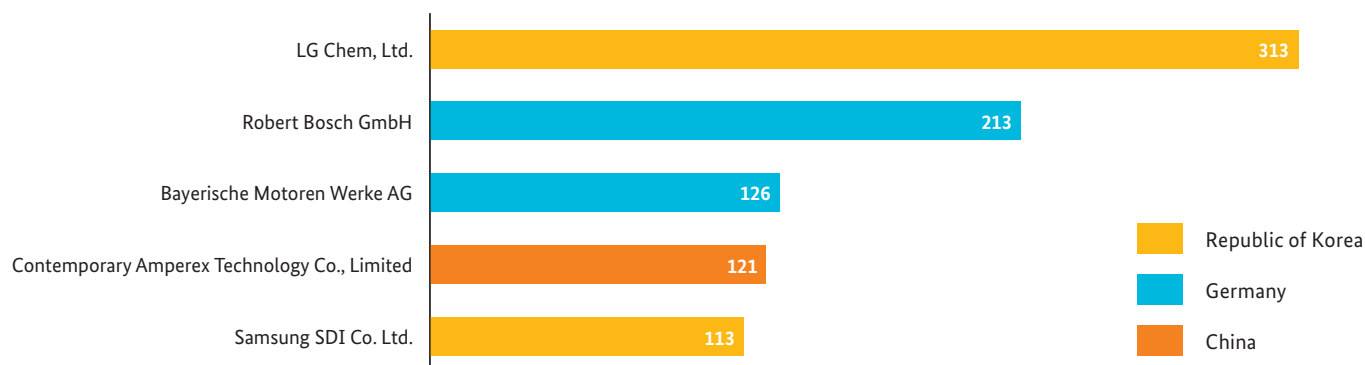
## Top 5 applicants in 2019<sup>1)</sup>

Rank	Applicant <sup>3)</sup>	Residence or principal place of business	Applications
1	LG Chem, Ltd.	KR	313
2	Robert Bosch GmbH	DE	213
3	Bayerische Motoren Werke AG	DE	126
4	Contemporary Amperex Technology Co., Limited	CN	121
5	Samsung SDI Co. Ltd	KR	113

<sup>1)</sup> Applications published by the DPMA and the EPO, avoiding double counting.

<sup>2)</sup> The totals do not precisely equal summed figures due to rounding differences.

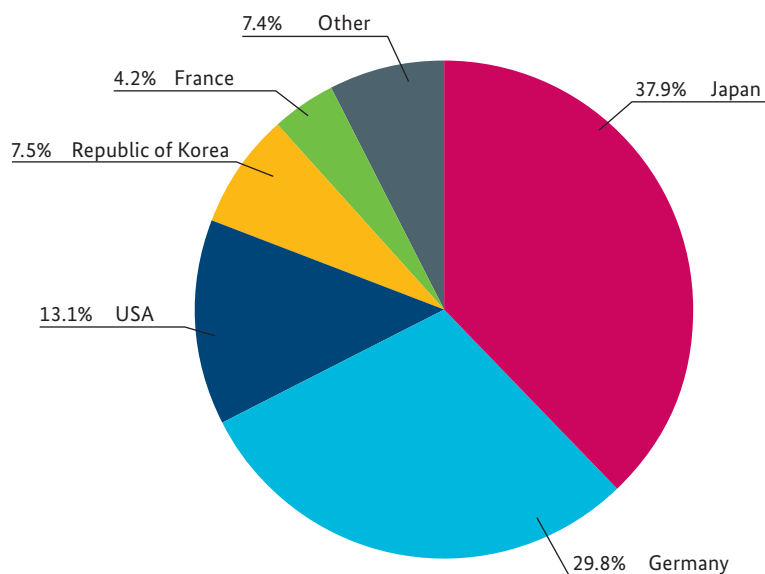
<sup>3)</sup> Applicant indicated first; without considering possible intra-group affiliations.



## Fuel cells

Patent applications with effect in Germany<sup>1)</sup> by country (residence or principal place of business of the applicant indicated first)

Country	Publication in 2019	
	Number	Percentage
Japan	321	37.9%
Germany	253	29.8%
USA	111	13.1%
Republic of Korea	64	7.5%
France	36	4.2%
Other	63	7.4%
<b>Total</b>	<b>848</b>	<b>100%</b>

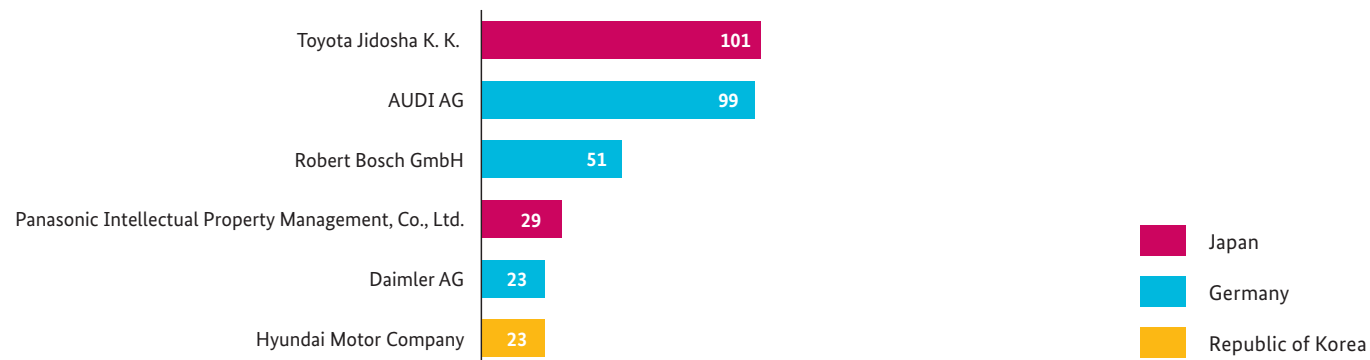


## Top 5 applicants in 2019<sup>1)</sup>

Rank	Applicant <sup>2)</sup>	Residence or principal place of business	Applications
1	Toyota Jidosha K.K.	JP	101
2	AUDI AG	DE	99
3	Robert Bosch GmbH	DE	51
4	Panasonic Intellectual Property Management, Co., Ltd.	JP	29
5	Daimler AG	DE	23
5	Hyundai Motor Company	KR	23

<sup>1)</sup> Applications published by the DPMA and the EPO, avoiding double counting.

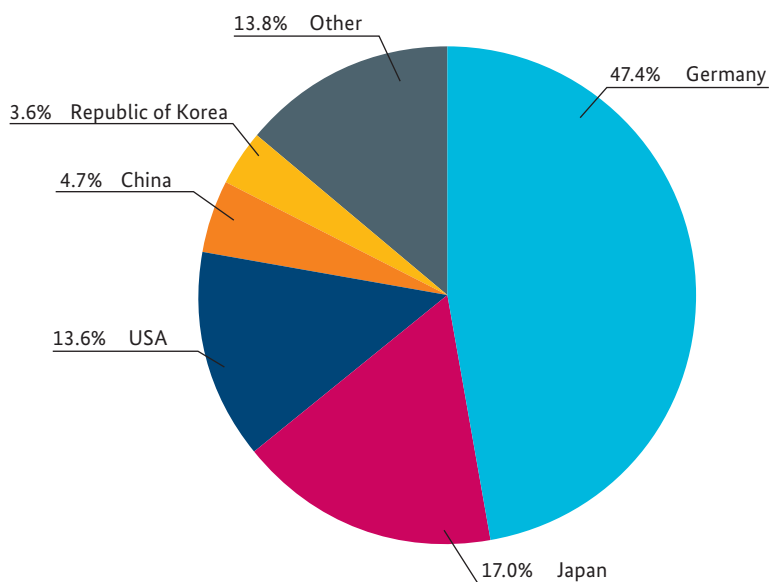
<sup>2)</sup> Applicant indicated first; without considering possible intra-group affiliations.



## Electric drive

### Patent applications with effect in Germany<sup>1)</sup> by country (residence or principal place of business of the applicant indicated first)

Country	Publication in 2019	
	Number	Percentage
Germany	313	47.4%
Japan	112	17.0%
USA	90	13.6%
China	31	4.7%
Republic of Korea	24	3.6%
Other	91	13.8%
<b>Total<sup>2)</sup></b>	<b>660</b>	<b>100%</b>



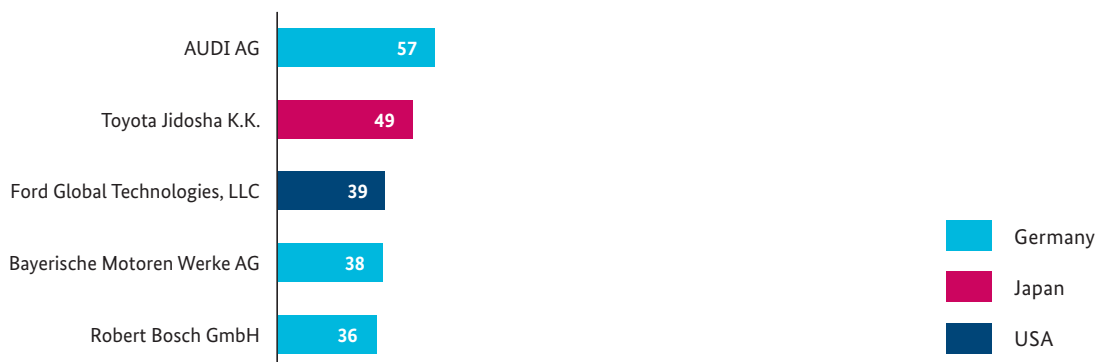
### Top 5 applicants in 2019<sup>1)</sup>

Rank	Applicant <sup>3)</sup>	Residence or principal place of business	Applications
1	AUDI AG	DE	57
2	Toyota Jidosha K.K.	JP	49
3	Ford Global Technologies, LLC	US	39
4	Bayerische Motoren Werke AG	DE	38
5	Robert Bosch GmbH	DE	36

<sup>1)</sup> Applications published by the DPMA and the EPO, avoiding double counting.

<sup>2)</sup> The totals do not precisely equal summed figures due to rounding differences.

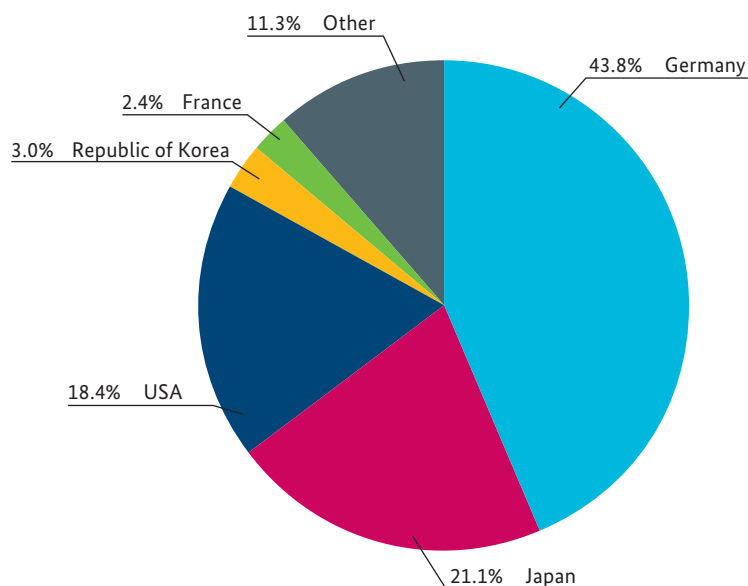
<sup>3)</sup> Applicant indicated first; without considering possible intra-group affiliations.



## Internal combustion engine

Patent applications with effect in Germany<sup>1)</sup> by country (residence or principal place of business of the applicant indicated first)

Country	Publication in 2019	
	Number	Percentage
Germany	1,613	43.8%
Japan	776	21.1%
USA	678	18.4%
Republic of Korea	112	3.0%
France	89	2.4%
Other	416	11.3%
<b>Total</b>	<b>3,683</b>	<b>100%</b>

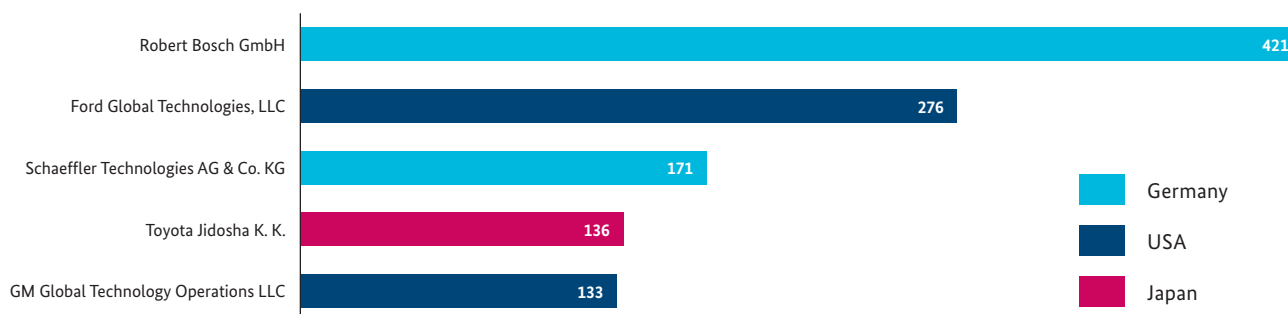


## Top 5 applicants in 2019<sup>1)</sup>

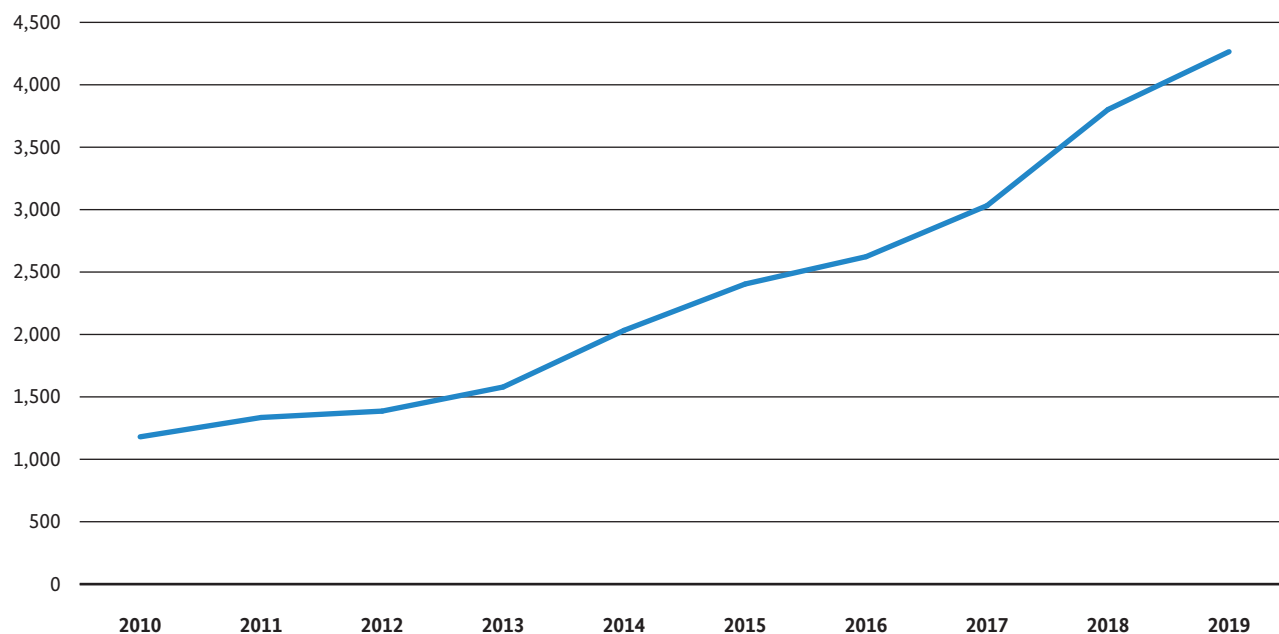
Rank	Applicant <sup>2)</sup>	Residence or principal place of business	Applications
1	Robert Bosch GmbH	DE	421
2	Ford Global Technologies, LLC	US	276
3	Schaeffler Technologies AG & Co. KG	DE	171
4	Toyota Jidosha K.K.	JP	136
5	GM Global Technology Operations LLC	US	133

<sup>1)</sup> Applications published by the DPMA and the EPO, avoiding double counting.

<sup>2)</sup> Applicant indicated first; without considering possible intra-group affiliations.



## Patent applications concerning autonomous driving with effect in Germany



## Development of the patent applications effective in Germany<sup>1)</sup>: Autonomous driving

	IPC <sup>2)</sup>	Year of publication									
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Autonomous driving - general drive control	G05D 1/00 - G05D 1/03	71	91	72	97	103	120	150	209	268	342
Assistance systems for drive control	B60W 30/00 - B60W 30/20 B60W 40/00 - B60W 40/13 B60W 50/00 - B60W 50/16 B60W 60/00	286	319	394	499	688	954	1,079	1,168	1,559	1,768
Assistance systems for traffic control	G08G 1/00 G08G 1/07 G08G 1/087 G08G 1/09 G08G 1/0962 - G08G 1/0967 G08G 1/097 - G08G 1/16	206	237	246	254	322	380	406	609	704	662
General electronics in the vehicle	B60R 16/02	159	203	184	219	349	369	382	376	395	378
Navigation	G01C 21/04 G01C 21/26 - G01C 21/36 B62D 6/00 - B62D6/04 B62D 1/24 - B62D1/28 G08G 1/0968, G08G 1/0969	331	367	331	331	346	360	348	416	486	559
Sensor technology Environment sensor systems	G06K 9/62 G01S 13/93 - G01S 13/931 G01S 15/93 - G01S 15/931 G01S 17/93 - G01S 17/931	125	117	156	177	219	215	252	245	353	467
Communication <sup>3)</sup>	H04W 4/40 - H04W 4/48	1	1	3	3	5	6	7	9	36	88
<b>Total<sup>4)</sup></b>		<b>1,180</b>	<b>1,335</b>	<b>1,386</b>	<b>1,579</b>	<b>2,033</b>	<b>2,404</b>	<b>2,623</b>	<b>3,032</b>	<b>3,802</b>	<b>4,265</b>

<sup>1)</sup> Applications published by the DPMA and the EPO, avoiding double counting.

<sup>2)</sup> IPC classes valid at the time of information retrieval are counted proportionately; not exhaustive; results not related to autonomous driving may be included.

<sup>3)</sup> Introduction of the IPC subclasses in 2018.

<sup>4)</sup> The totals do not precisely equal summed figures due to rounding differences.

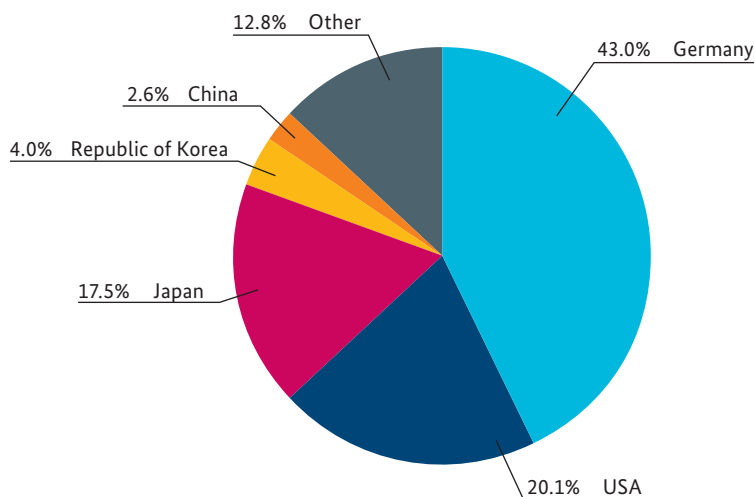
# Autonomous driving

(as of February 2020)

## Autonomous driving

Patent applications with effect in Germany<sup>1)</sup> by country (residence or principal place of business of the applicant indicated first)

Country	Publication in 2019	
	Number	Percentage
Germany	1,832	43.0%
USA	857	20.1%
Japan	746	17.5%
Republic of Korea	172	4.0%
China	110	2.6%
Other	548	12.8%
<b>Total</b>	<b>4,265</b>	<b>100%</b>



## Top 5 applicants in 2019<sup>1)</sup>

Rank	Applicant <sup>2)</sup>	Residence or principal place of business	Applications
1	Robert Bosch GmbH	DE	357
2	Ford Global Technologies, LLC	US	290
3	Bayerische Motoren Werke AG	DE	277
4	Daimler AG	DE	266
5	GM Global Technology Operations LLC	US	208

<sup>1)</sup> Applications published by the DPMA and the EPO, avoiding double counting.  
<sup>2)</sup> Applicant indicated first; without considering possible intra-group affiliations.

