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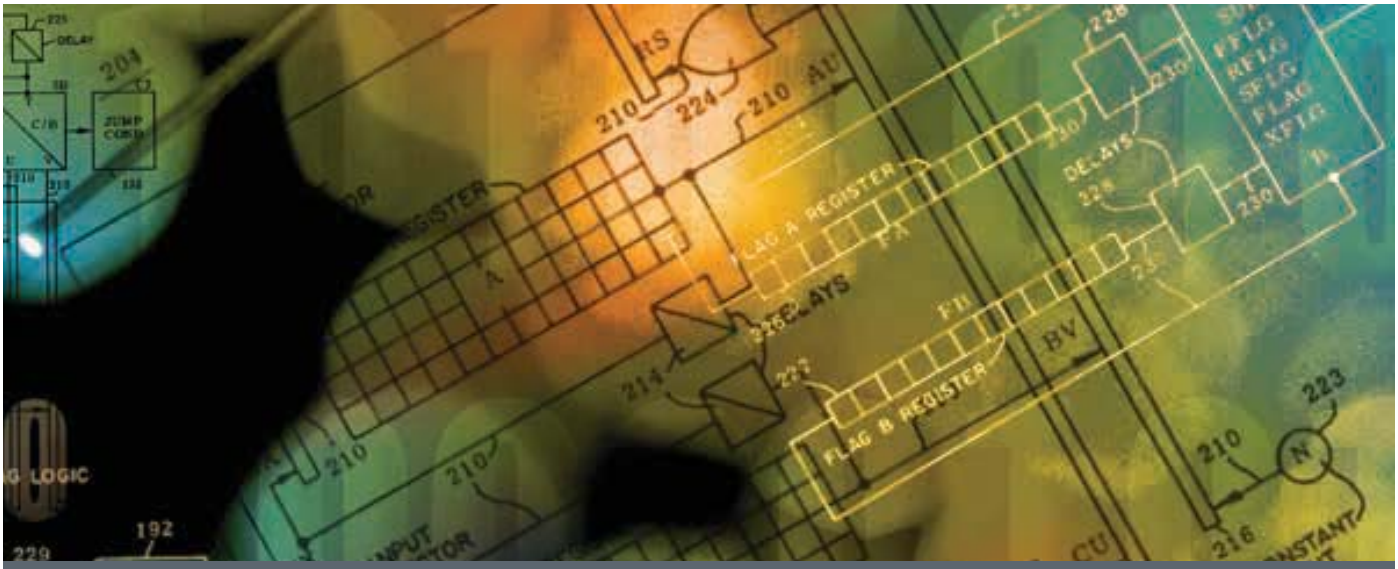


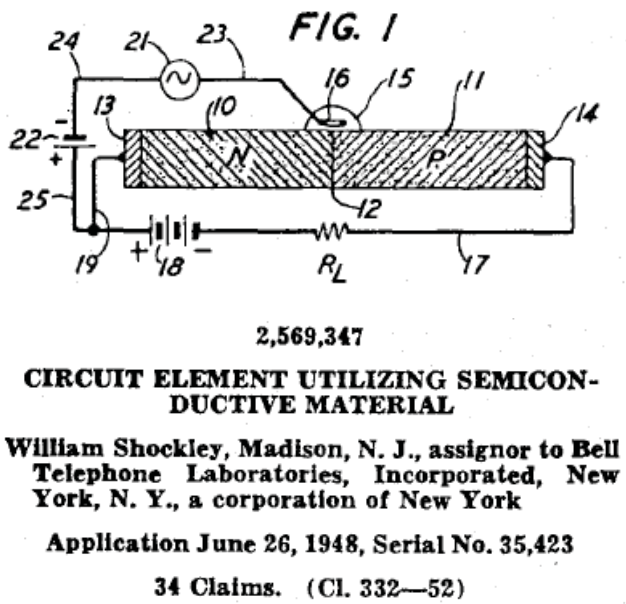
WHITE PAPER

February 2017

Trends in Semiconductor Industry Patent Prosecution and Litigation 2017

As semiconductor firms continue to make significant investments in research and development activities—totaling $34 billion in 2015, according to one calculation—it follows that industry participants will engage in actions necessary to protect the inventions and technological advances produced by those efforts. This Jones Day *White Paper* reviews patent prosecution and litigation trends in the semiconductor industry. The *White Paper* concludes with a summary of what semiconductor industry participants can expect relating to patent matters in the months ahead.

"Intellectual property is the lifeblood of the semiconductor industry."[1] Since 1948, when William Shockley applied for a patent on his junction transistor,[2] semiconductor patents may well have contributed as much to the evolution of the industry as the very inventions they protect. Indeed, the conventional wisdom is that the continued success of the industry depends "on a strong and balanced patent system."[3]



On average, semiconductor industry firms invest one-fifth of their revenue in research and development.[4] In 2015, that investment totaled $34 billion.[5] For at least the near future, industry leaders expect to continue to increase research and development spending.[6] Naturally, companies strive to protect the inventions resulting from the expenditure of such substantial sums. To that end, the United States Patent and Trademark Office ("USPTO") issued nearly 22,000 semiconductor patents in 2015.

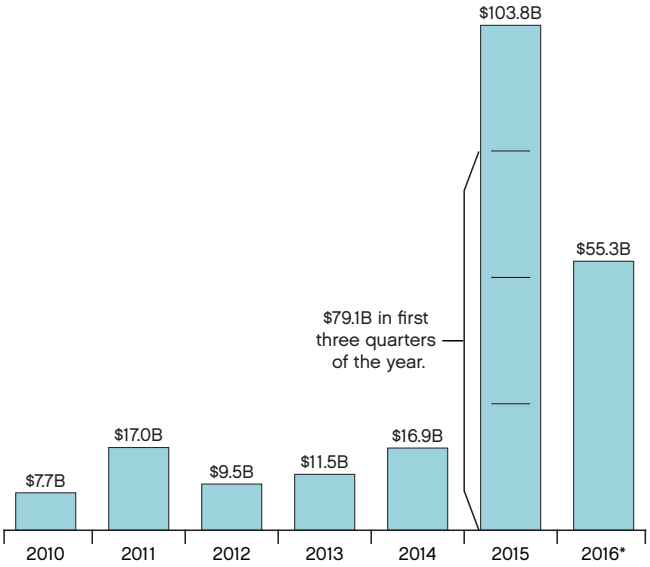
The semiconductor industry is sometimes described as being composed of three types of companies: (i) foundries, or "fabs," that manufacture semiconductors, (ii) "fabless" companies that design semiconductors and partner with a foundry for their manufacture, and (iii) integrated device manufacturers that both design and fabricate their own semiconductors. Companies like TSMC and GlobalFoundries are examples of foundries, Qualcomm and Broadcom are often identified as examples of fabless firms, and Intel and Samsung are usually labeled as integrated device manufacturers. Of course, this rather simplistic breakdown overlooks the contributions of firms that provide equipment, services, and software to the semiconductor industry, such as Applied Materials and Synopsys. Figure 1 represents a list of the 20 largest firms, based on semiconductor sales in the first half of 2016.

Recently, there has been a significant upward trend in merger and acquisition activity in the sector, as illustrated by Figure 2. For example, from 2011 through 2014, there were only about 15 deals per year that averaged roughly $1.3 billion each. A dramatic increase in 2015 occurred, with 23 deals at an average value of $4.3 billion through just the first three quarters of that year.[7] While 2016 may not surpass the previous year, it was still a significant year for merger activity, including Qualcomm's announced acquisition of NXP for $47 billion, and Analog Devices' announced acquisition of Linear Technology for $14.8 billion.

Figure 1: Top 20 in Semiconductor Sales (1H 2016)[8]

1	Intel
2	Samsung
3	TSMC
4	Broadcom
5	Qualcomm
6	SK Hynix
7	TI
8	Micron
9	Toshiba
10	NXP
11	MediaTek
12	Infineon
13	ST
14	Apple
15	Global Foundries
16	Renesas
17	Nvidia
18	Sony
19	UMC
20	AMD

Figure 2: Value of Semiconductor M&A Agreements



*As of mid-September 2016.
Source: IC Insights

PATENT PROSECUTION

Over the past 10 years, the number of semiconductor patents granted increased by 50 percent. As Figure 3 illustrates, this included a 30 percent spike in 2010 alone. Around that time, the USPTO reduced total pendency, which is measured by the time from filing to disposition, but that factor alone does not account for the sustained increase in patented inventions. The increase in grants is more likely the result of the twofold increase in research and development expenditures over the last decade.[9]

The top semiconductor patentees in 2015, listed in Figure 4, are a diverse mix of entities from around the globe. TSMC, the leader, received 1,298 semiconductor patents in 2015, nearly four times the 345 patents received in 2011. IBM received 1,058 patents in 2015, the year it divested its chip-making business, which is roughly the same number it received in 2011. Samsung Electronics received 939 patents in 2015, slightly less than the 1,122 patents it was granted in 2011. Samsung Display, a spinoff established in 2012, received 779 patents in 2015. Semiconductor Energy Laboratory received 761 patents in 2015, roughly a 50 percent increase over the 491 patents received in 2011.

Figure 3: Semiconductor Devices and Manufacturing U.S. Patents Granted[10]

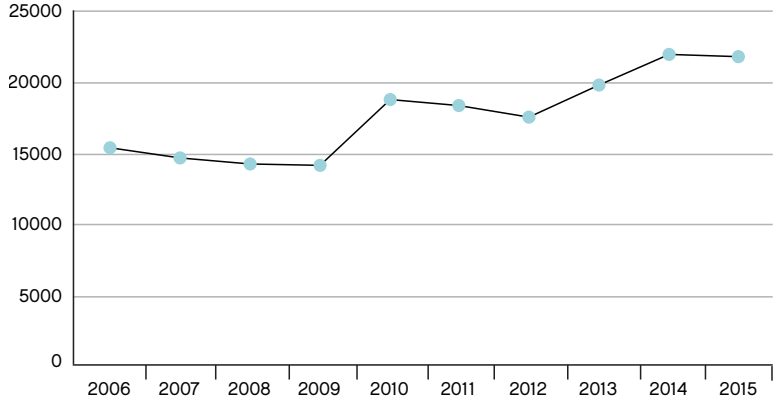


Figure 4: Semiconductor Devices and Manufacturing U.S. Patents Granted (2015)[11]

Taiwan Semiconductor Manufacturing Co., Ltd.	1298
International Business Machines Corporation	1058
Samsung Electronics Co., Ltd.	939
Samsung Display Co., Ltd.	779
Semiconductor Energy Laboratory Co., Ltd.	761
Toshiba Corporation	749
GlobalFoundries Inc.	442
Micron Technology, Inc.	437
SK Hynix Inc.	398
Infineon Technologies AG	314
Renesas Electronics Corp.	311
Freescale Semiconductor, Inc.	263
Sony Corporation	261
Applied Materials, Inc.	250
Intel Corporation	234
United Microelectronics Corporation	215
Tokyo Electron Limited	204
LG Display Co., Ltd.	198
Panasonic Intellectual Property Management Co., Ltd.	185
Texas Instruments Incorporated	182
LG Innotek Co., Ltd.	167
Canon Kabushiki Kaisha	162
Sharp Kabushiki Kaisha (Sharp Corporation)	159
Macronix International Co., Ltd.	153
Stats Chippac Ltd.	150
Mitsubishi Denki Kabushiki Kaisha	143
Intermolecular Inc.	136
Osram Opto Semiconductors GMBH	129
Qualcomm, Inc.	125
Rohm Co., Ltd.	122
Commissariat a L'Energie Atomique et Aux Energies Alternatives	122
Infineon Technologies Austria AG	121
Boe Technology Group Co., Ltd.	110
Sumitomo Electric Industries, Ltd.	103

DISTRICT COURT LITIGATION

District court litigation involving semiconductor patents increased from 79 suits in 2008 to a peak of 141 in 2013, as illustrated in Figure 5. The dramatic dip in suits filed in 2009 is likely attributable to the economic recession of 2008. After declining in 2014 and 2015 to around 70 cases per year, district court cases are once again on the rise, with more than 100 suits filed in 2016.

Semiconductor patent litigation suits are mainly concentrated in a few districts. In 2016, just five districts handled three-fourths of the suits that were filed—E.D. Texas (30), District of Delaware (23), C.D. California (12), S.D. California (9), and N.D. California (9).

Figure 6 lists the semiconductor plaintiffs in district court litigation since 2012, and Figure 7 lists the defendants. In the past five years, the most litigious plaintiffs were Boston University (43 suits), Semcon Tech (23), North Star Innovations (18), and Bluestone Innovations (16). Parties defending the most semiconductor patent infringement suits during that time included Samsung (18), Toshiba (11), Vizio (10), Acer (9), and LG Electronics (9).

Figure 5: U.S. District Court Cases—Semiconductor Devices[12]

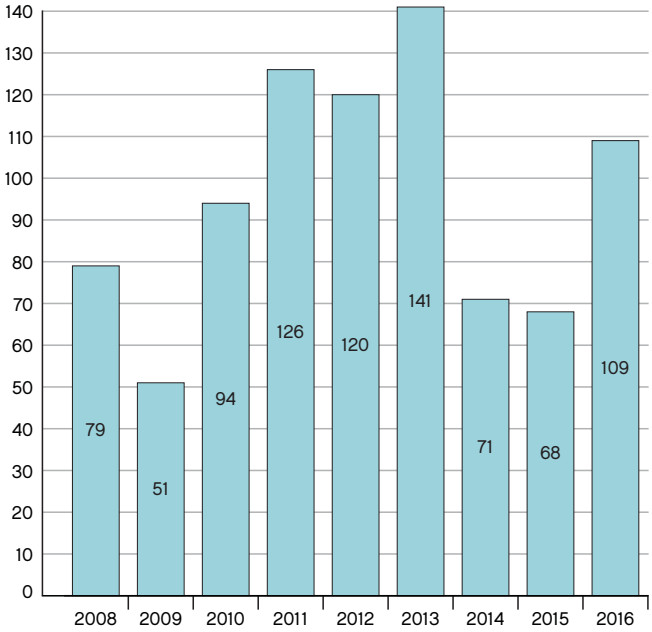


Figure 6: U.S. District Court Cases—Semiconductor Plaintiffs (2012–16)[13]

Plaintiff	Suits
Trustees of Boston University	43
Semcon Tech, LLC	23
North Star Innovations Inc.	18
Bluestone Innovations LLC	16
Nichia Corporation	13
Graphics Properties Holdings, Inc.	12
CpuMate Inc.	11
Golden Sun News Techniques Co., Ltd.	11

continued on next page

Figure 6: U.S. District Court Cases—Semiconductor Plaintiffs (2012–16)[13]

Plaintiff	Suits
Anza Technology, Inc.	9
Rockstar Consortium US LP	7
Round Rock Research LLC	7
Bitro Group, Inc.	7
Collabo Innovations, Inc.	7
MobileStar Technologies LLC	7
Super Interconnect Technologies LLC	7
Koninklijke Philips NV	6
Mariner IC Inc.	6
Joseph Neev	6
Lone Star Silicon Innovations LLC	6
Philips Lighting North America Corporation	5
Solid State Storage Solutions, Inc.	5
Philips Solid-State Lighting Solutions, Inc.	5
In-Depth Test LLC	5
Tela Innovations, Inc.	5
Cree, Inc.	5
DSS Technology Management, Inc.	5

Figure 7: U.S. District Court Cases—Semiconductor Defendants (2012–16)[14]

Defendant	Suits
Samsung Electronics Co., Ltd.	18
Samsung Electronics America, Inc.	17
Samsung Semiconductor, Inc.	12
Toshiba Corporation	11
Samsung Austin Semiconductor, LLC	10
VIZIO, Inc.	10
Acer America Corporation	9
Acer Inc.	9
LG Electronics, Inc.	9
LG Electronics USA, Inc.	9
Sony Electronics, Inc.	8
Toshiba America, Inc.	8
Micron Technology, Inc.	7
ASUSTeK Computer Inc.	7
Sony Corporation	6
GBT, Inc.	6
Giga-Byte Technology Co., Ltd.	6
Toshiba America Electronic Components, Inc.	6
Texas Instruments Incorporated	5

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Figure 7: U.S. District Court Cases—Semiconductor Defendants (2012–16)[14]

Defendant	Suits
IKEA North America Services LLC	5
HTC America, Inc.	5
Toshiba America Information Systems, Inc.	5
Sony Corporation of America	5
Canon USA, Inc.	5
OmniVision Technologies, Inc.	5
Intel Corporation	5
Apple Inc.	5

PATENT TRIAL AND APPEAL BOARD

As Figure 8 illustrates, more than 200 petitions have been filed relating to semiconductor patents since the *inter partes* review procedure ("IPR") launched in 2012. In 2015 and 2016, IPR petitions were filed at a level slightly lower than the number of suits filed in district court.

The PTAB instituted review on 68 percent of petitions filed on semiconductor patents on decisions issued through the end of 2016. This is comparable to the average institution rate for all patents.

At least some claims in IPRs involving semiconductor patents were found unpatentable in 97 percent of final written decisions issued by the end of 2016. This outcome is higher than the overall 84 percent unpatentable rate in decisions for all patents.

Figure 9 lists the petitioners for IPRs of semiconductor patents since 2012, and Figure 10 lists the most active semiconductor patent owners. The most active petitioners included Samsung (34 petitions), Micron Technology (28), TSMC (18), and SK Hynix (16). Patent owners most frequently defending their semiconductor patents in IPR proceedings included Daniel Flamm (18), Elm 3DS Innovations (16 petitions), Godo Kaisha IP Bridge (12), Cree (11), and DSS Technology Management (10).

Figure 8: *Inter Partes* Review Proceedings—Semiconductor Devices[15]

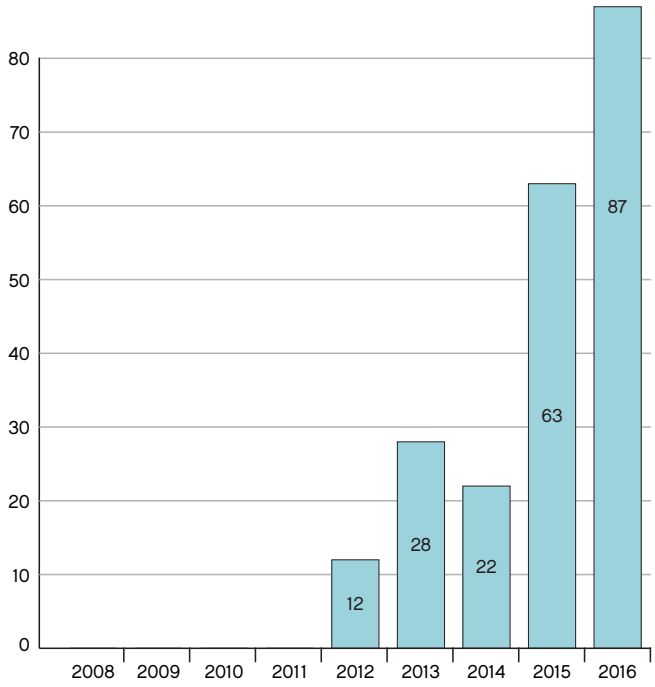

Figure 9: *Inter Partes* Review Proceedings—Semiconductor Petitioners (2012–16)[16]

Petitioner	IPRs
Samsung Electronics Co., Ltd.	34
Samsung Electronics America, Inc.	28
Micron Technology, Inc.	28
Samsung Semiconductor, Inc.	25
Samsung Austin Semiconductor, LLC	22
Taiwan Semiconductor Manufacturing Company, Ltd.	18
SK hynix Memory Solutions, Inc.	16
SK hynix America Inc.	16
Hynix Semiconductor Manufacturing America, Inc.	16
SK hynix, Inc.	16
Micron Semiconductor Products, Inc.	16
Micron Consumer Products Group, Inc. d/b/a Lexar	15
GLOBALFOUNDRIES Inc.	11
Intel Corporation	11
GLOBALFOUNDRIES US, Inc.	11
Lam Research Corporation	9
SunLED Co. LLC	8
Kingbright Co. LLC	8
SunLED Corp.	8
Kingbright Electronic Co., Ltd.	8
Sunscreen Company Limited	8

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Figure 9: *Inter Partes* Review Proceedings—Semiconductor Petitioners (2012–16)[16]

Petitioner	IPRs
Kingbright Corp.	8
Sony Electronics, Inc.	7
Sony Corporation	7
Qioptiq Photonics GmbH & Co. KG	6
Sony Corporation of America	6
Excelitas Technologies Corp.	6
ASML US, Inc.	6
ASML Netherlands BV	6
NVIDIA Corporation	6

Figure 10: *Inter Partes* Review Proceedings—Semiconductor Patent Owners (2012–16)[17]

Patent Owner	IPRs
Daniel L Flamm	18
Elm 3DS Innovations, LLC	16
Godo Kaisha IP Bridge 1	12
Cree, Inc.	11
DSS Technology Management, Inc.	10
Tessera, Inc.	6
In-Depth Test LLC	6
Samsung Electronics Co., Ltd.	6
Enthone Inc.	6
Wi-LAN, Inc.	6
Energetiq Technology, Inc.	6
IP Bridge	6
Document Security Systems, Inc.	5
Trustees of Boston University	5
Spansion LLC	5
Round Rock Research LLC	5
Amkor Technology, Inc.	4
Tessera Technologies, Inc.	4
Nichia Corporation	4
Raytheon Company	4
Home Semiconductor Corporation	4
Xilinx, Inc.	4
Wi-LAN Technologies, Inc.	4
Collabo Innovations, Inc.	4
ProMOS Technologies Inc.	4
Ziptronix, Inc.	4
Knowles Electronics LLC	4

ITC PROCEEDINGS

After peaking in 2011, semiconductor patent-related investigations in the International Trade Commission ("ITC") declined in popularity, as Figure 11 illustrates.

Figure 12 identifies the complainants in ITC investigations involving semiconductor patents since 2008, and Figure 13 lists the respondents. Since 2008, investigations have been initiated on complaints filed by Samsung (5), Freescale Semiconductor (5), Spansion (4), Knowles Electronics (4), Tessera (3), and Hewlett-Packard (3). Respondents included LG Electronics (9) and Samsung (7).

Figure 11: International Trade Commission Proceedings—Semiconductor Devices[18]

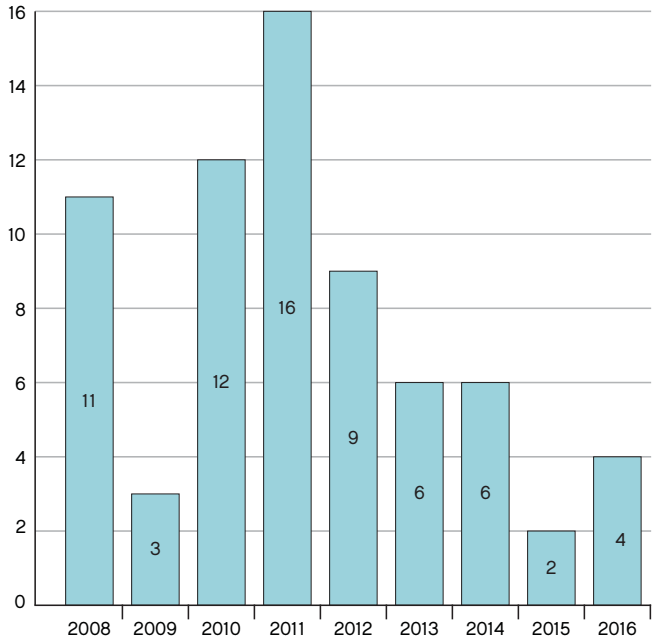

Figure 12: International Trade Commission Proceedings—Semiconductor Patent Complainants (2008–16)[19]

Complainant	ITC Proceedings
Samsung Electronics Co., Ltd.	5
Freescale Semiconductor, Inc.	5
Spansion LLC	4
Knowles Electronics LLC	4
Tessera, Inc.	3
HP Inc.	3
Graphics Properties Holdings, Inc.	2
Gertrude Neumark Rothschild	2
Sharp Corporation	2

continued in next column

Figure 12: International Trade Commission Proceedings—Semiconductor Patent Complainants (2008–16)[19]

Complainant	ITC Proceedings
Silicon Genesis Corporation	2
OSRAM GmbH	2
Thomson Licensing SAS	2
Thomson Licensing LLC	2
Macronix America, Inc.	2
Macronix International Co., Ltd.	2
OSRAM AG	2

Figure 13: International Trade Commission Proceedings—Semiconductor Patent Respondents (2008–16)[20]

Respondent	ITC Proceedings
LG Electronics, Inc.	9
LG Electronics USA, Inc.	8
Samsung Electronics America, Inc.	7
Samsung Electronics Co., Ltd.	7
Research In Motion Corporation	5
Kingston Technology Company, Inc.	5
ASUSTeK Computer Inc.	5
BenQ America Corp.	5
VIZIO, Inc.	5
BenQ Corporation	5
Research In Motion Limited	5
Apple Inc.	5
Sony Corporation	5
HTC America, Inc.	5
HTC Corporation	5
Acer Inc.	5
Sony Ericsson Mobile Communications, AB	4
Sony Corporation of America	4
Elpida Memory, Inc.	4
Tellabs, Inc.	4
Sony Electronics, Inc.	4
Nokia Corporation	4
Spansion, Inc.	4
Sanyo Electric Co., Ltd.	4
LG Electronics Mobilecomm USA, Inc.	4
Acer America Corporation	4
Microsoft Mobile Inc. f/k/a/ Nokia Inc.	4

THE FUTURE

Given the expected continuing increase in research and development spending, it is likely that the number of semiconductor patents granted will continue to increase for years to come. With more granted patents, we anticipate that there will also be an increase in semiconductor patent litigation despite the ongoing consolidation in the industry. By reducing potential competitor disputes, mergers among rivals might tend to slow the rate of litigation somewhat. However, mergers between noncompetitors may be less likely to impact the upward litigation trend. Litigation involving nonpracticing entities is not likely to be affected by consolidation among industry members.

We expect that district courts in California, Delaware, and Texas will continue to handle the most semiconductor suits, absent changes in the current venue determination rules. Legislative efforts to limit venue stalled in Congress in 2016. However, in a closely watched case, the United States Supreme Court granted a petition for writ of certiorari regarding the interpretation of the current patent venue statute.[21] In *TC Heartland*, the petitioner questions whether 28 U.S.C. § 1400(b) is the sole and exclusive provision governing venue in patent infringement actions, thus confining venue to "the judicial district where the defendant resides, or where the defendant has committed acts of infringement and has a regular and established place of business." One study concluded that about half the suits filed by nonpracticing entities would need to be filed in another district under a more limited interpretation of venue.[22]

Given the extremely favorable rate at which semiconductor patent claims are held unpatentable in IPRs, we expect petitions will be continue to be filed at a rate commensurate with that of district court suits.

Despite the lower number of complaints filed in comparison with suits in district court, the ITC remains an attractive venue for semiconductor patent owners. The ITC provides for relatively swift adjudication and offers a strong remedy in the form of an exclusion order banning the import of infringing products. Furthermore, in contrast to litigation in district courts, the ITC is unlikely to stay an investigation in favor of IPR proceedings.[23]

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ENDNOTES

1 Semiconductor Industry Association, *Intellectual Property*.

2 U.S. Patent No. 2,569,347 (claiming a "solid conductive device for controlling electrical energy that comprises a body of semiconductive material having two zones of one conductivity type separated by a zone of the opposite conductivity type").

3 Semiconductor Industry Association, *supra* note 1.

4 *Id*.

5 Semiconductor Industry Association, *Semiconductors by the Numbers*.

6 KPMG, *Global Semiconductor Outlook 2016*, at 10.

7 Helen Chen *et al*., *Winning through M&A? Deal making in the semiconductor sector*, McKinsey & Company.

8 IC Insights Strategic Reviews Database, "1H 2016 Top 20 Semiconductor Sales Leaders."

9 Semiconductor Industry Association, *2016 Factbook 17* (March 2016).

10 U.S. Patent and Trademark Office, Patent Technology Monitoring Team Report, *Semiconductor Devices and Manufacturing, Number of Patents Granted as Distributed by Year of Patent Grant*.

11 *Id*., *Organizational Patentees With 25 or More Patents Granted During the Period*.

12 DocketNavigator Analytics.

13 *Id*.

14 *Id*.

15 *Id*.

16 *Id*.

17 *Id*.

18 *Id*.

19 *Id*.

20 *Id*.

21 *In re TC Heartland LLC*, 821 F.3d 1338 (Fed. Cir. 2016), *cert. granted*, 2016 WL 4944616 (U.S. Dec. 14, 2016) (No. 16-341).

22 Colleen V. Chien & Michael Risch, *Recalibrating Patent Venue*.

23 Blaney Harper *et al*., "ITC Refuses to Stay Investigation Pending *Inter Partes* Review," Jones Day *Commentary*.

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