

Cipher Solutions Technology Trends

Using Cipher for Technology Trends Analysis

[Link to Landscape report](#)



GaN for Power Delivery



SiC for Power Delivery



Si for Power Delivery

A power semiconductor device is a semiconductor device used as a switch or rectifier in power electronics (for example in a switch-mode power supply). Such a device is also called a power device or, when used in an integrated circuit, a power IC. Power semiconductors are found in systems delivering as little as a few tens of milliwatts for a headphone amplifier, up to around a gigawatt in a high voltage direct current transmission line.

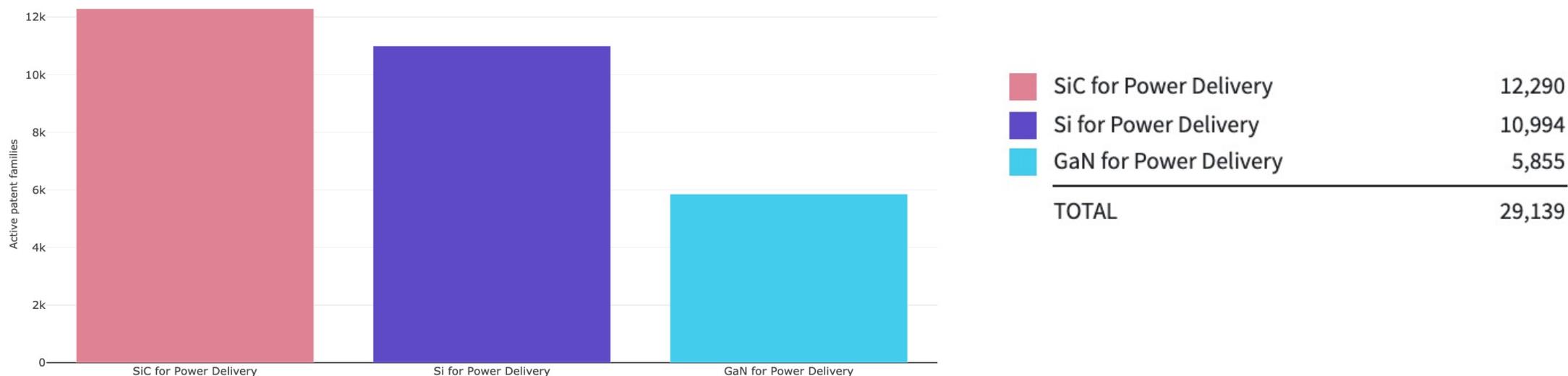
The classifiers in this presentation look at the use of different materials in these applications. These are **Gallium Nitride, Silicon Carbide & Silicon**. The names of the classifiers in the report are shown here, on the left.



Technology Trends

Analysing technology landscapes to predict trends in the space, and spot disruptors

SIZE | How many are there across the tech space?



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SIZE – Number of Active Families, by technology

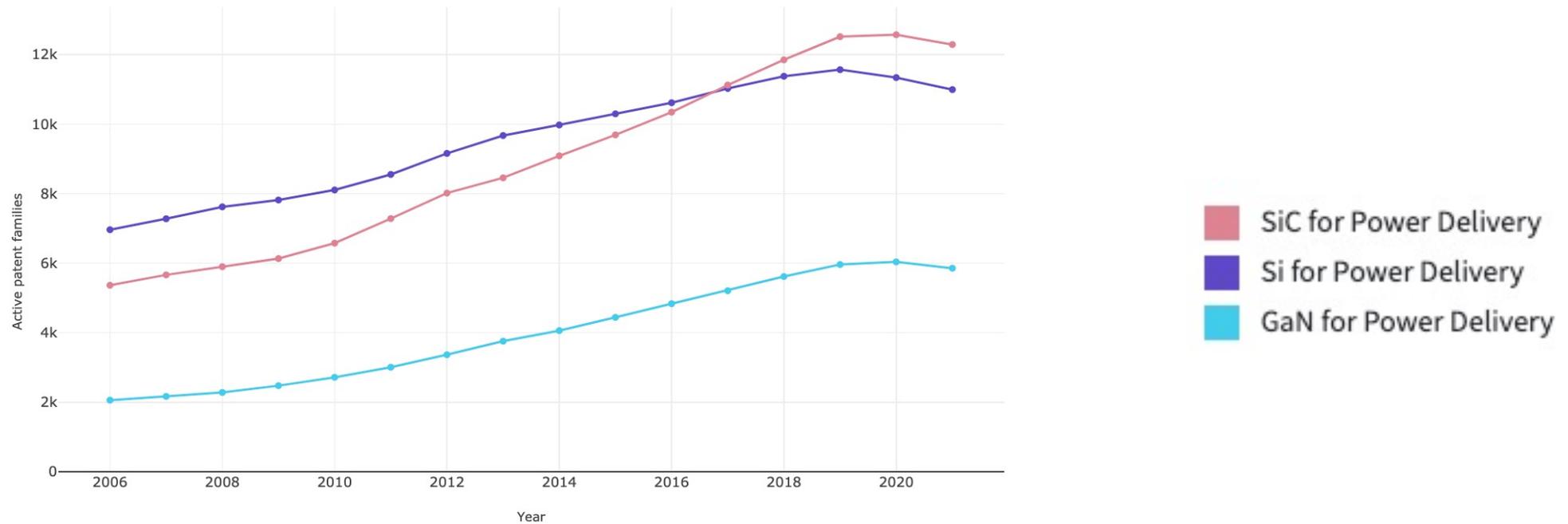
How many active families (pending and granted) are there, across these three technology areas?

Which is the biggest technology? Which is the smallest?

This chart allows you to compare numbers across the technology areas. There is no assessment of organisations owning patents in the space at this time, as we're carrying out a review of the technology space as a whole first.

We can see that Silicon Carbide is the area where there are most active families, and Gallium Nitride is the smallest.

TRENDS | Is the technology increasing or decreasing in size?



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PORTFOLIO TRENDS – Number of Active families, by technology and year

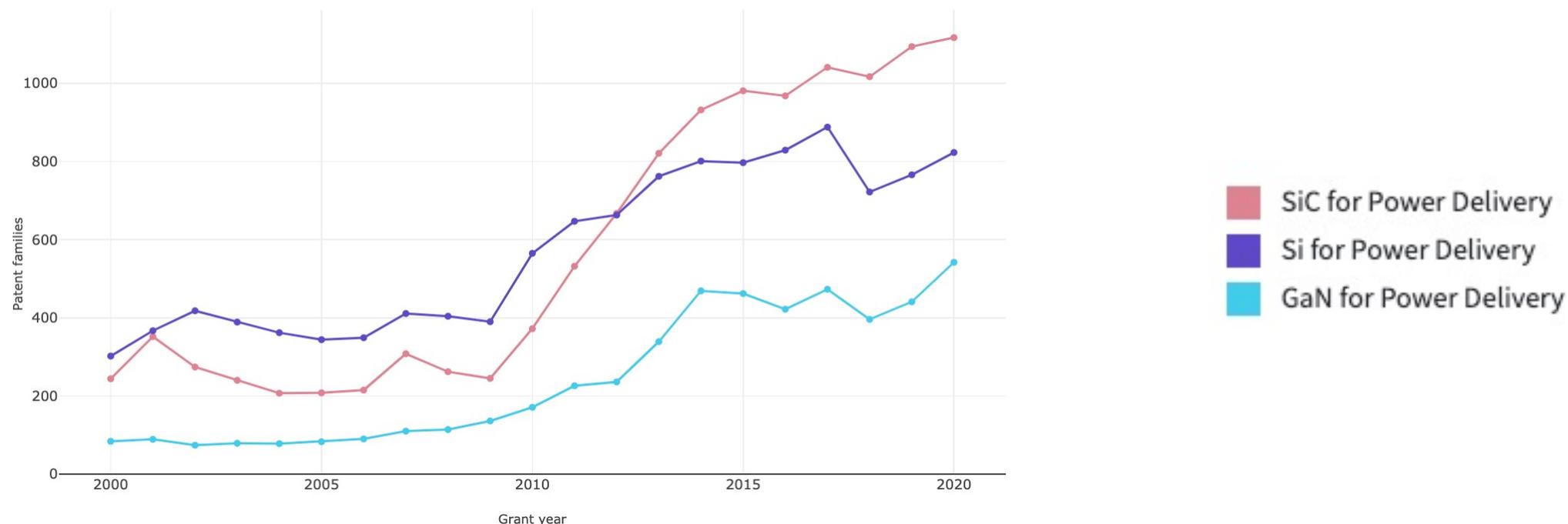
How is the total number of families in these technologies changing year on year?

Are there technologies that are increasing, and of interest for further analysis?

Looking at the trends in how many patent families there are (of status pending or granted in each year), we can see that Silicon Carbide is rising more than the others.

The trend is towards Silicon Carbide now, so if you're working in Silicon you may wish to switch to SiC.

ACTIVITY | Are the rates of granted families increasing or decreasing?



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PATENTING ACTIVITY – Number of Granted families, by technology and grant year

How many families have been granted for each technology in each year?
 Have the numbers of granted families, significantly changed over the years?

Are the numbers granted for each technology increasing or decreasing, and at what rate? Are there fluctuations that we see that we should dig into?

If there is a year where grants rose from that point, for example 2009 for Silicon Carbide, then perhaps we should click into those assets and review the PVIX strength score to understand if these were foundational filings.

GEOGRAPHY | Where are others protecting their assets, and should I follow suit?

	United States	China	Japan	Germany	Taiwan	Korea, Republic of	EPO	France	United Kingdom	Italy	Next 50	TOTAL
Si for Power Delivery	5,598	3,611	2,420	1,290	811	806	442	289	301	155	1,073	16,796
SiC for Power Delivery	3,457	4,588	3,040	646	670	574	325	214	205	119	625	14,463
GaN for Power Delivery	3,136	1,471	1,288	418	517	505	300	255	216	107	679	8,892
TOTAL	12,191	9,670	6,748	2,354	1,998	1,885	1,067	758	722	381	2,377	40,151

[Click here to access this Cipher chart](#)

GEOGRAPHY- Number of families with Grants, by technology and country

Is there a focus to grant in specific countries across the technologies?

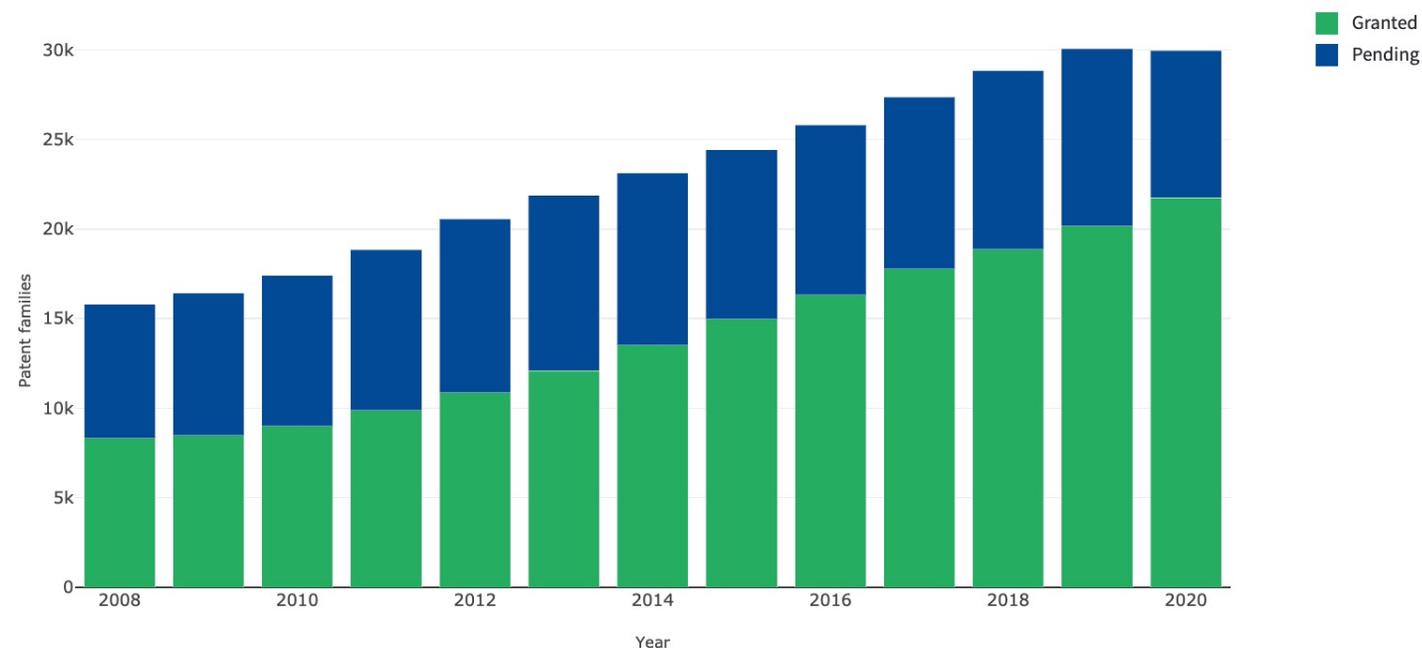
Is there much variation across the three technology areas?

Number of families with grants per geography is a clear signal for established technologies in reviewing trends.

If a technology area is brand new then you may wish to look at active or pending assets.

You can see here that there is a focus across the US, China and Japan.

TRENDS | Is the tech area on track for growth or reduction?



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PORTFOLIO TRENDS – Number of Granted vs pending families, by year

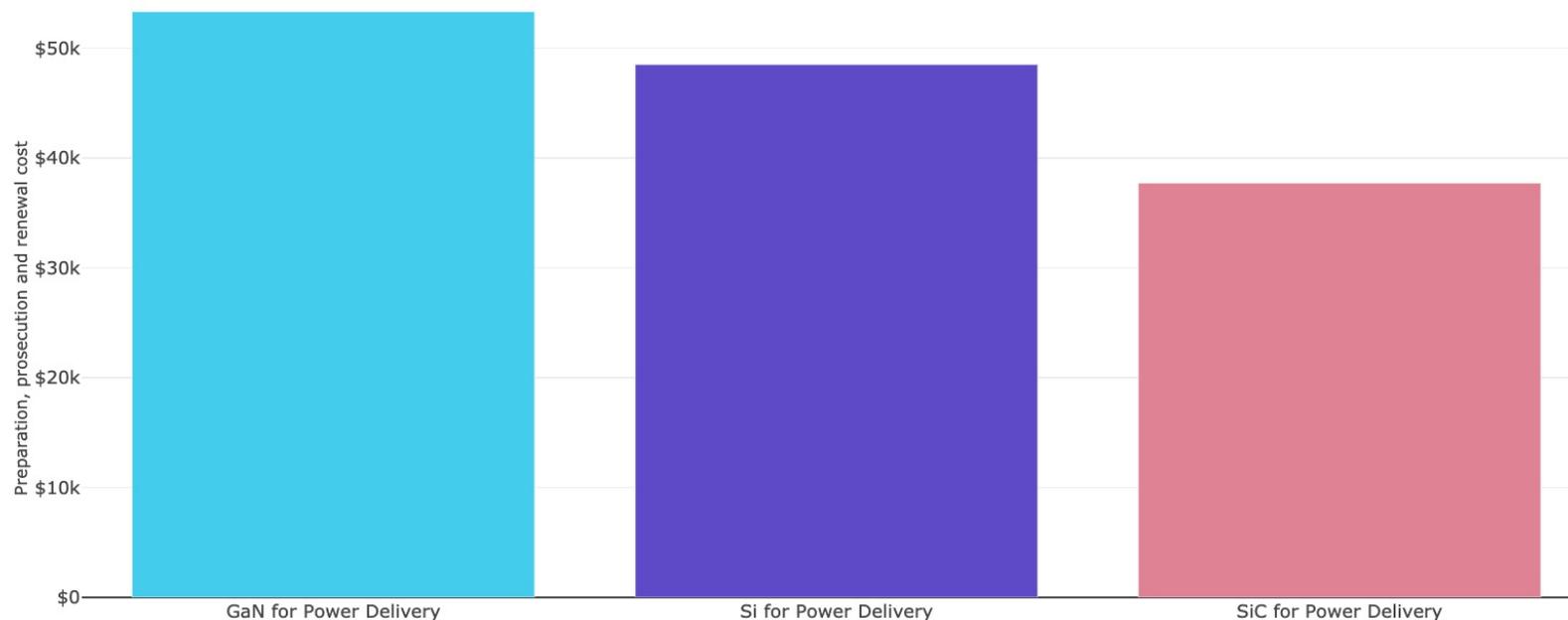
Is the tech space on a trajectory for growth or reduction?

Should we invest more time and effort into our portfolio in this area, if the space is already slowing?

If pending outstrips green, it's a signal that it's a new technology area.
 If its about even, then the space is growing.
 If there's a substantial amount of granted, and pending is not increasing at the same rate, then the technology is getting into a comfortable level.

Here we review the results over the three tech areas, but you could filter to the individual technologies to review the trend in each.

COST | Which tech area has the highest average cost per family?



Technology	Preparation, prosecution and renewal cost
GaN for Power Delivery	\$53,302
Si for Power Delivery	\$48,486
SiC for Power Delivery	\$37,698

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Cost– Average cost per family, by tech

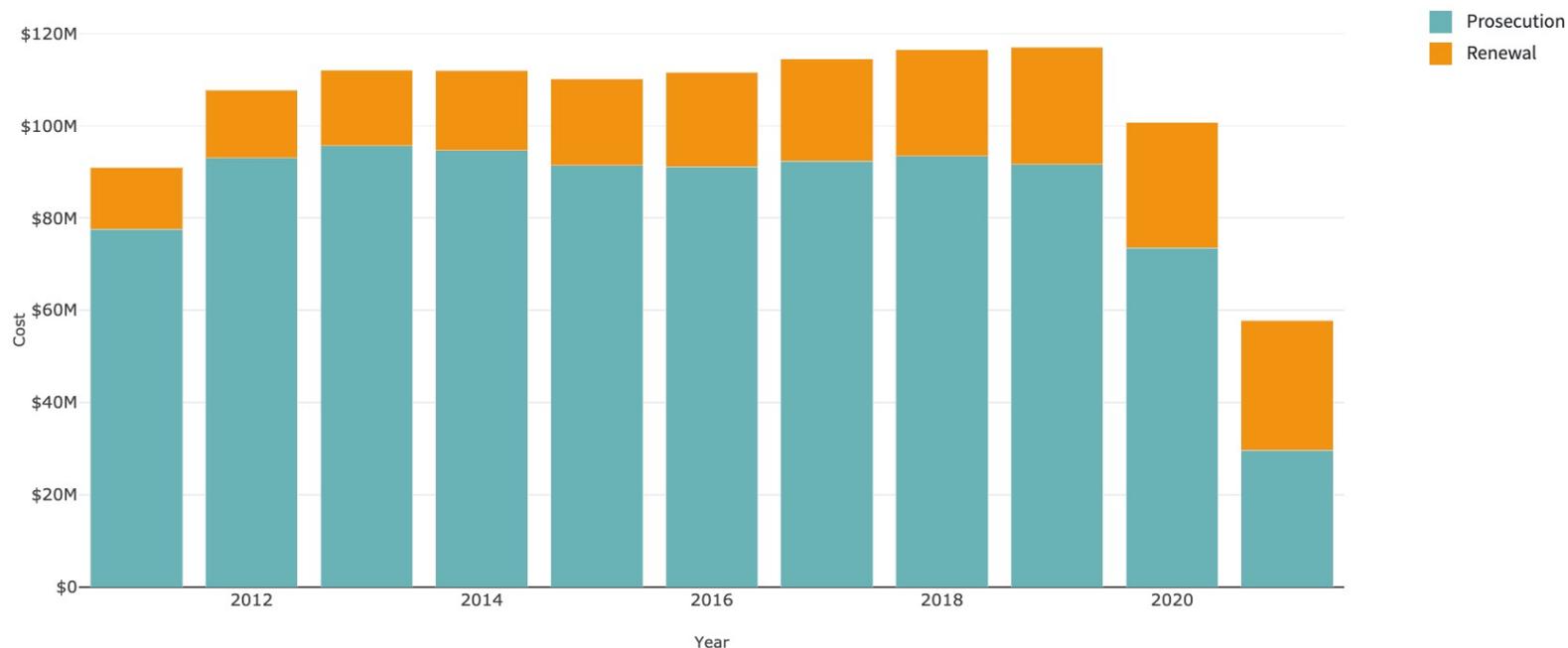
What is the average spend per family per tech, and how do we compare to that?

Does one tech look more promising than another, because more is being spent in that area?

There is a higher average cost per family for Gallium Nitride. Is this what we would expect?

You could compare average time to grant metrics, and geographical analysis to understand a bit more about the increased spend in this technology.

COST | Is more being spent on new filings or on renewals?



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COST- Prosecution vs renewal cost, by year

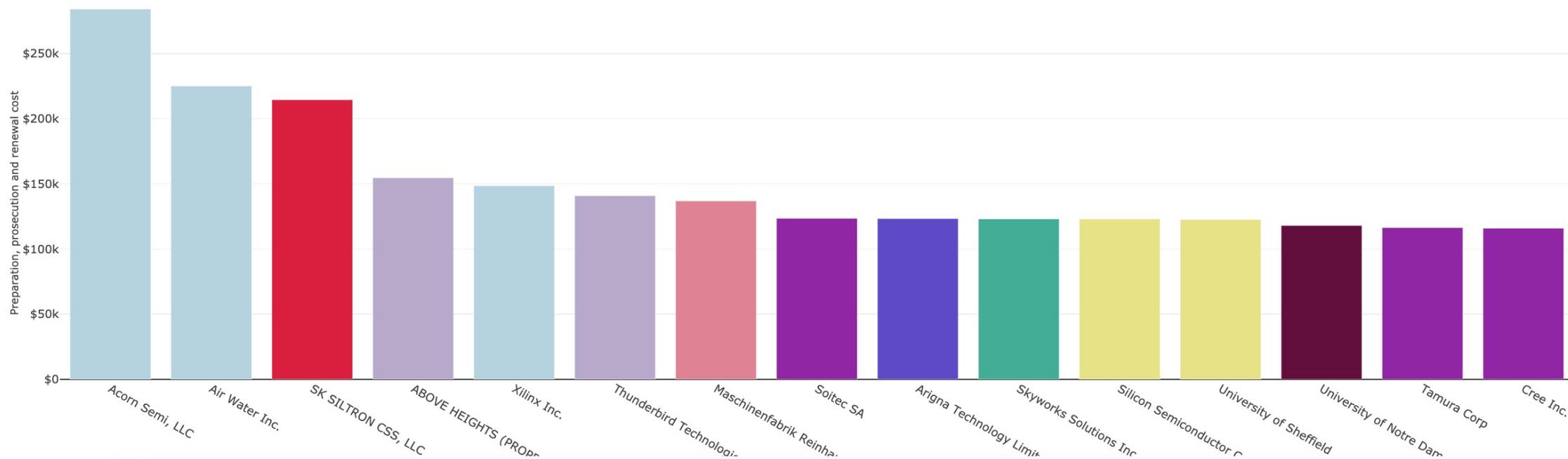
How much are companies spending on keeping patents alive vs filing new inventions?
Is the area growing or reducing? Is the curve flattening?

If prosecution costs in blue are greater than renewal costs in orange, the space is growing.

If renewal costs in orange are greater than prosecution costs in blue, the technology is reducing.

So based on this, do you decide whether to buy assets or to build?

COST | Who is spending the most per patent family in the space?



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Cost- Average cost per family, by organisation

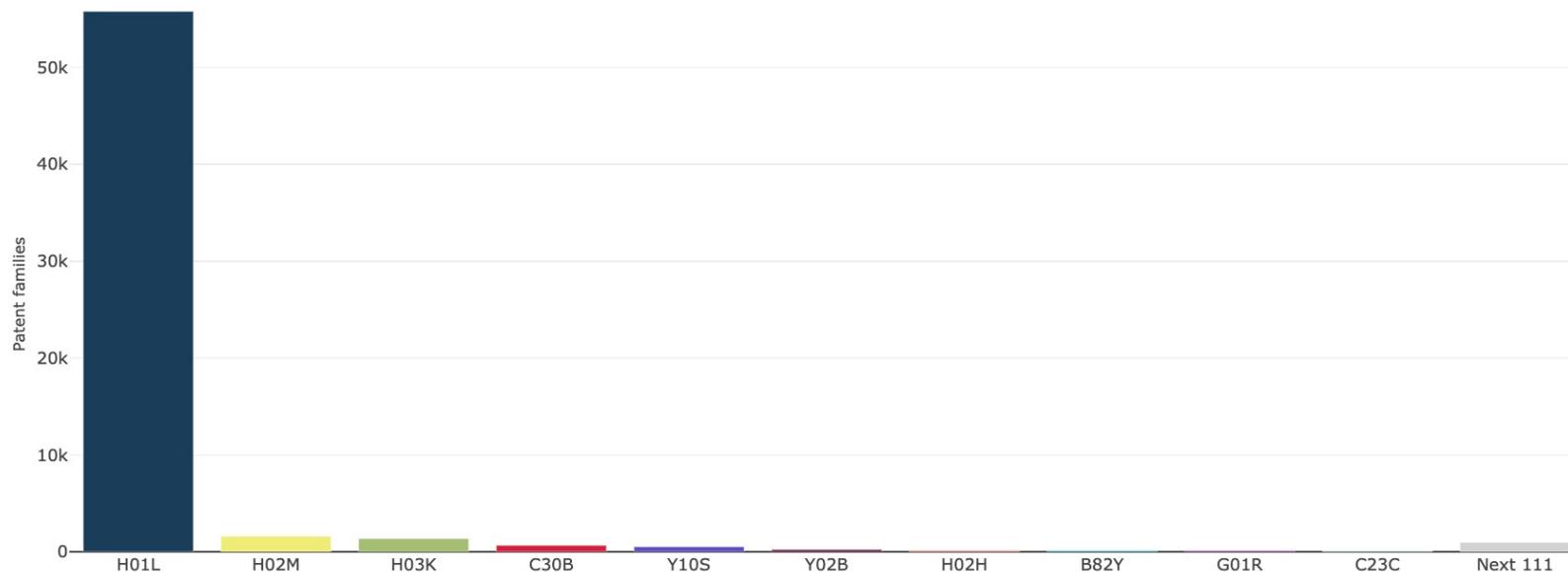
Who is spending the most?

How do we compare to these organisations?

What makes a patent expensive?

Do they take a long time to grant? Are you preparing lots of patents to be filed? Are you filing in multiple territories? Are you keeping a large portfolio alive? How long are you keeping those alive for?

PORTFOLIO STATS | What can the CPC codes of the tech area tell us?



CPC code	Patent families
H01L	55783
H02M	1611
H03K	1357
C30B	666
Y10S	515
Y02B	227
H02H	165
B82Y	144
G01R	124
C23C	113
Next 111	965
TOTAL	61670

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PORTFOLIO STATS - Families, by CPC Code

What CPC codes make up the results of the classifier landscape report in these three tech areas?

What insights can we take from the combination of CPC codes?

This chart is tech focused and breaks down classifier results to CPC Codes. You could use the time slider in your report to see how these CPC results shifts in more recent years.

Y - CPC codes for example, are unique to the US patent office and not normally provided for by the current structure of the CPC Code classification tree.

PORTFOLIO STATS | How long does it take each organisation to get a grant in the tech space?

	Rohm	Hitachi	Sumitomo Electric	Panasonic	Fujitsu	Semiconductor Manufacturi...	On Semiconductor	Fuji Electric	Toyota	Denso	Infineon Tech	Chinese Academy of Science	Hua Hong	Mitsubishi Electric	Renesas Electronics	Taiwan Semiconductor	Toshiba	Xidian U	University of Electronic	Texas Instr
Si for Power Delivery	4.1	3.4	2.6	3.4	2.5	3.8	3	2.9	2.8	2.8	2.8	2.7	2.9	2.8	2.5	2.5	2.3	2.2	2.2	1.7
SiC for Power Delivery	4	3	3.2	1.9	3.5	2.8	4	3.1	3.2	3	2.5	2.8	2.9	2.8	2.4	2.4	2.2	2.1	1.9	1.9
GaN for Power Delivery	3.9	2.9	3.6	3.8	3	2.4	1.8	2.5	2.6	2.4	2.9	2.4	2	2.1	2.4	2.1	2.3	2	2.1	2.2

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PORTFOLIO STATS – Average time to grant, by org and technology

How long does it take each organisation to grant?

How difficult or easy is it to get a grant in the tech space?

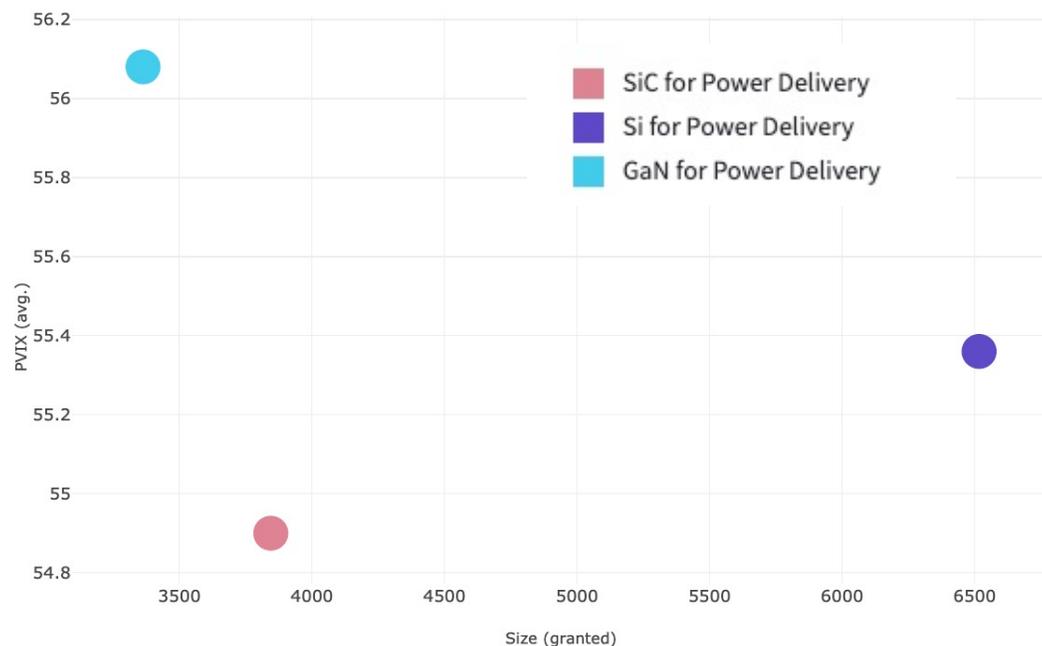
Here we look at the top 20 owners of granted families across the tech areas. This chart helps you to figure out how easy or difficult it is to get a patent grant in the tech space.

The longer the company pursues the prosecution of the application, the more committed they are to the tech. Changing claims significantly, or a large amount of prior art could result in longer times, that might also signify high quality assets. Or a short time to grant, might be due to new tech where there is minimal prior art.

(You could review the metrics here across all orgs in the landscape report, but could also look at you and your top competitors)

Similarly, if the average age to grant is 10 years, then you shouldn't be put off if it takes six years for you to grant.

PVIX | Is there a big difference in patent strength across the tech space?



Technology	Size (granted)	PVIX (avg.)
GaN for Power Delivery	3363	56.08
Si for Power Delivery	6517	55.36
SiC for Power Delivery	3845	54.9

[Click here to access this CIPHER chart](#)

PVIX –Average PVIX (a measure of strength) by technology and size

How does the size of the portfolio in each tech space, compare with the strength of the assets?

Is there a big variation in size and strength across the three tech areas?

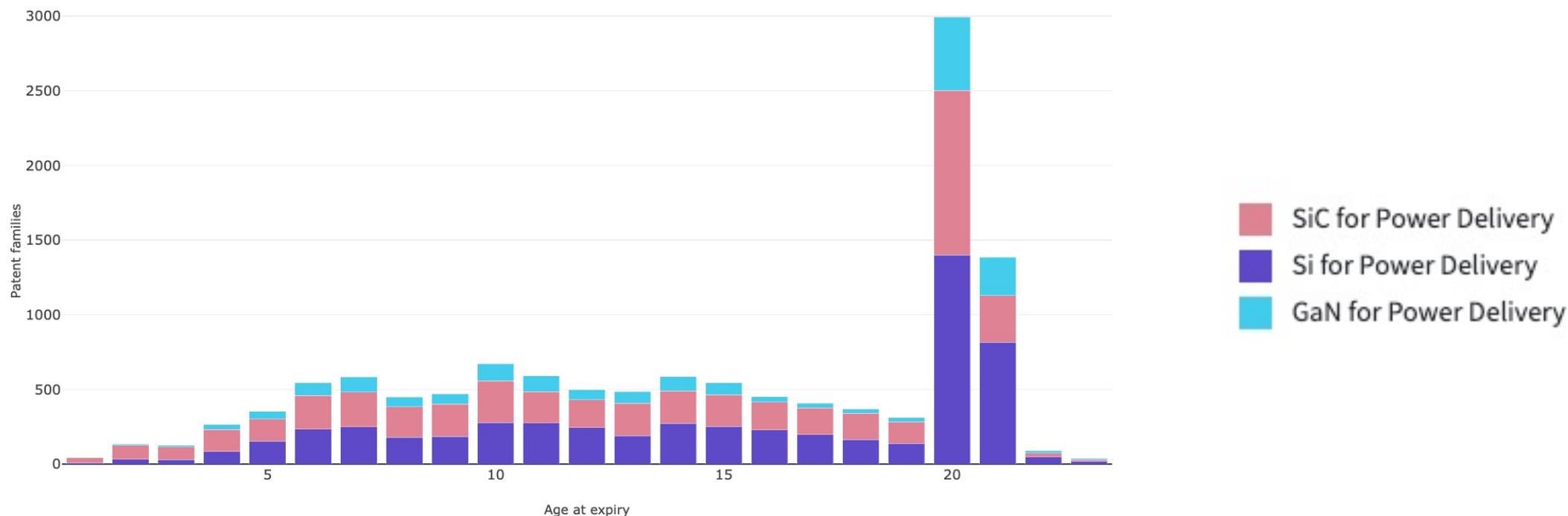
This chart is all about comparing portfolio size to the strength of the assets.

If there is a big difference in patent strength between technologies, I may wish to read the top scoring patents to understand - these are really old so have a higher pvix score (high number of citations) or these are new so have a lower pvix score (less citations). Is there a large discrepancy in size between the techs and does that have an influence of the comparison of pvix?

If assets are older, and the size of the portfolio is larger, there is more time to get more citations, and also grants in a wider set of jurisdictions.

Is it unexpected that one tech is close to another? If so, you can refer to charts chart to see how old these technology areas are and does the PVIX score make sense.

AGE | How long are patents kept alive for, in the tech space?



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AGE – Historical expiry age per family, by technology

At what age do most patent families in this tech space expire?
Is there a trend for organisations to expire patents earlier than 20 years?

This is a useful metric to review if the technology is established. It is useful to review and see if the orgs in this space let them expire at 15 years, rather than 20 for example.

If you have seen that the filing rate is slowing down in your tech area of interest, you may decide to also scale down your portfolio in that area as the market may be moving away from that technology.

Average age at expiry is also a good metric to look at if you're looking to prune your own portfolio.

DISPUTES | What's the risk of exposure across the tech space?

	Renesas Electronics	North Plate	Infineon Tech	Vishay Intertechnology	Mitsubishi Electric	On Semiconductor	Third Dimension	Cree	Seoul Semiconductor	MaxPower Semiconductor	Fuji Electric	Semiconductor Manufactur...	Texas Instr	Private owner	Taiwan Semiconductor	Next 2003	TOTAL
Si for Power Delivery	18	12	7	4	3	3	3	0	1	2	0	1	1	0	0	6	61
SiC for Power Delivery	4	0	0	1	1	0	0	2	0	0	1	0	0	1	1	6	17
GaN for Power Delivery	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	4
TOTAL	22	12	7	5	4	3	3	2	2	2	1	1	1	1	1	15	82

[Click here to access this Cipher chart](#)

DISPUTES – Litigated patent families by organisation, & technology

Who owns litigated patent families in the tech space?
 Who is particularly aggressive across the three tech areas?

This chart shows the owners of litigated families in the tech space.

This chart helps to answer questions such as 'what's the risk of exposure in these tech areas? Here we can see that it tends to be the top five organisations asserting patents. I should be aware that these orgs are quite litigious, and if I'm in silicon for power delivery I need to be prepared.

If you're a company filing in a technology that has a high number of litigations, you might choose to right size your portfolio in that area. By rightsizing your portfolio, you're assessing and ideally reducing the risk in that area. Rightsizing considers - How much revenue do I have in that area? Based on that, do I need a big defence in a tech area or not?

ACTIVITY | Who is new to the tech space, and are they a threat?

	Renault	Hong Kong	NUVOTON TECHNOLOGY	Council of Scientific	Toshiba Infrastructure	3-5 Power	Xidian U	SHANGHAI HESTIA	JTEKT	Flosfia	National Taiwan U	Tamura	Southeast U	Sanan Optoelectronics	Sogang U	United Silicon	Sungkyunkwan U	Huawei Technologies	Excelliance Mos	Synopsys	Silergy	Kwangwoon U	CSI
GaN for Power Delivery	2016	2018	2015	2017	2017	2016	2017	2016	2014	2014	2014	2011	2019	2016	2019	2013	2007	2012	2018	2015	2019	2013	2010
SiC for Power Delivery	2018	2018	2018	2016	2016	2016	2011	2013	2017	2014	2012	2011	2011	2019	2010	2012	2014	2014	2010	2018	2008	2013	2010
Si for Power Delivery	2018	2015	2018	2017	2016	2016	2018	2017	2015	2016	2018	2019	2010	2005	2011	2014	2018	2012	2009	2004	2009	2010	2010

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PATENTING ACTIVITY - Entrance year, by organisation and technology

When did the top organisations first file in these technologies?
Are these organisations early or late adopters?

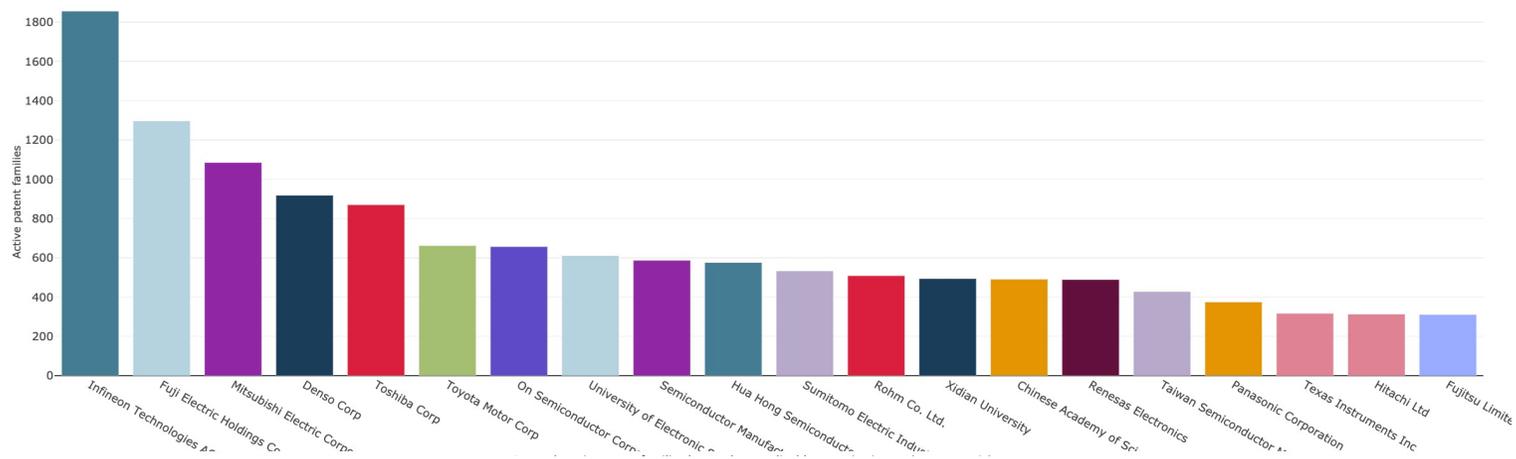
There seems to be an even spread across the technologies here. We're looking at most recent entry dates to the tech space (by priority year), and. *for this analysis here we have filtered out those patent families with only a filing in China*

You can start to ask questions such as 'Are they going to be a threat? How many do they have? Are they a Potential target for M&A? Are they infringing my IP?'. Why is X company now interested in this space?

Like any chart in cipher you can click the data point to review the individual patent families and inventions associated with the metrics of the chart.

You may choose to use this chart to spot universities or academic institutes to look to license or acquire their IP.

SIZE | So which organisations own the most patents in the tech space?



Organisation	Active patent families
Infineon Technologies AG	1856
Fuji Electric Holdings Co. Ltd.	1297
Mitsubishi Electric Corporation	1085
Denso Corp	918
Toshiba Corp	870
Toyota Motor Corp	662
On Semiconductor Corporation	657
University of Electronic Science and Technology of China	611
Semiconductor Manufacturing International Corp	587
Hua Hong Semiconductor Ltd	576
Sumitomo Electric Industries Ltd	533
Rohm Co. Ltd.	509
Xidian University	494
Chinese Academy of Sciences	491
Renesas Electronics	489
Next 3450	18900

[Click here to access this Cipher chart](#)

SIZE- Number of active families, by organisation

Who are the largest owners in the tech space?
How many do they have?

This dataset shows how many patent families each organisation has across the tech areas of the report. You can use the technology filter to find the results of each individual power delivery type.

This is a good introduction to the next part of your analysis we like to call 'Competitor Intelligence' with a focus on those organisations in the space, rather than the tech area as a whole.

Cipher Help Centre information and useful links

- [How to run a landscape report as mutually exclusive](#)
- [How to interpret Cipher Datasets](#)
- [Data Sources](#)
- [Cipher Cost Data](#)

Cipher Report:

<https://app31.cipher.ai/report/a887cf3829>

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