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Semiconductor topography IP rights: Is there possibility for revival?

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Contents

Summary

The semiconductor industry has a *sui generis* IP type dedicated to it: the semiconductor topography right. This right was introduced in 1984 with the purpose of protecting the U.S. semiconductor industry from East Asian, mainly Japanese, competition. It replaced the principle of treatment on a national basis that is the norm in IP law with one of material reciprocity, which allowed the U.S. to strongarm other states into adopting similar legislation. Japan did this first, followed by almost every other state eventually throughout the late 1980's and later.

There was an attempt by the WIPO to create a treaty that would harmonise these rules for these rights, but it failed to gain ratification by enough states to enter into force. Instead the ongoing negotiations to form the WTO partly included it in their 1994 TRIPS Agreement, removing the most controversial parts, such as compulsory licensing, and changing the length and start of the period of protection.

The material rules most notably include a reverse engineering exception, and a definition of the protected subject matter that relies on an analogy to copyrighted artistic works. The reverse engineering exception allows for copying protected topographies so far as they are changed enough to have a level of originality that separates them from the copied work. Due to the extent of the exception has gained in case law it has become controversial. The definition of the protected subject matter protects either the layout of the chip design or the template used to make it. It has variations in regards to single layers in the chip topography, the materials used to make them, the methods used to make them, and the intermediate stages of production. These details are not harmonised worldwide, creating a situation where the definition varies worldwide.

The law was not met with much use in court and there are many theories that seek to explain this. Many point to the reverse engineer exception, some claim the usefulness of the law is limited due to technological sophistication of the subject matter. Others still claim that the law is lacking in usefulness due to the short commercial lifetime if individual IC chip topographies.

In order to make the law more useful for the semiconductor industry and to help countries protect their semiconductor industries this paper suggests further harmonisation and reforming of the protected subject matter, synchronising the period of protection and registration requirements with the more popular patents, abolishing the obsolete principle of reciprocity, limiting the reverse engineering exception and harmonising the sanctions and remedies available to holders of semiconductor topography rights.

Sammanfattning

Halvledarindustrin har en form av immaterialrätter avsedd särskilt för dem: Kretsmönsterrätter. Dessa introducerades i USA 1984 i syfte att skydda den amerikanska halvledarindustrin från konkurrens från östra Asien, huvudsakligen Japan. Den ersatte principen om nationell behandling med den materiella ömsesidighetsprincipen, som är normen inom immaterialrätt. Detta tillät USA att tvinga andra länder att anta liknande lagstiftning genom att förvägra deras medborgare skydd enligt denna lag fram tills de inför en motsvarighet i sitt egna land. Japan blev först att införa en sådan lag, så småningom följt av nästan alla andra länder från sent 1980-tal och framåt.

Det gjordes ett försök av WIPO att få till stånd ett mellanstatligt för att harmonisera reglerna för dessa rättigheter, men det trädde aldrig i kraft eftersom inte tillräckligt många länder ratificerade avtalet. Istället var det de pågående WTO-förhandlingarna som kom att ge avtalet nytt liv, genom att införliva det i 1994 TRIPS-avtal. Där togs tvångslicensiering, en av de mest kontroversiella delarna, bort. Längden och tidpunkten för början av skyddstiden ändrades också.

De materiella reglerna innehåller framför allt ett undantag från skyddet för dekonstruktion och en definition av skyddsföremålet som bygger på upphovsrättskyddade konstverk. Dekonstruktionsundantaget stadgar att så länge en kopia innehåller en förändring som är tillräckligt originell för att separera det nya verket från det kopierade verket är det tillåtet att reproducera det ny verket. På grund omfattningen undantaget fått genom domstolspraxis har det blivit kontroversiellt. Definitionen av skyddsföremålet skyddar antingen själva kretsmönstret eller mallen som används för att tillverka det. Definitionen varierar med avseende på enskilda lager i kretsmönstret, tillverkningsmaterialet, tillverkningsmetoden, och halvfärdiga kretskort. Dessa detaljer är inte harmoniserade världen över, vilket leder till att de varierar mellan länder.

Lagen har åberopats sparsamt i domstol. Det finns teorier om att detta beror på dekonstruktionsundantaget. Andra menar att lagen saknar användning på grund av den reglerade teknikens grad av sofistikation. Dessutom påstås också att lagen inte används eftersom kretskort har kort för kommersiell livstid.

Denna uppsats föreslår att reformera och stärka harmoniseringen av skyddsföremålets definition, synkronisera skyddstiden med de mer populära patenten, att avskaffa den obsoleta materiella ömsesidighetsprincipen, begränsa dekonstruktionsundantaget, samt harmonisera påföljds- och skadeståndsregelverken i syfte att göra lagen mer användbar för halvledarindustrin samt att hjälpa länder skydda sina halvledarindustrier.

Preface

In the beginning of the paradigm of global economy defined by the use of the internet, computers, sophisticated automation, and electronics there was the integrated circuit(IC) chip, on which all these technologies depend for their most basic functioning. The production of IC chips was almost exclusively carried out in the US, and there was a wild-west style competition for technology between the market actors. There were few, if any, attempts to enforce creators' intellectual property(IP) rights in regards to any kind of intellectual concepts used when producing them.

Attitudes changed when the rest of the world started catching up with the US, however. Across the Pacific Ocean in particular, there were countries, most notably Japan, that managed to capture a sizeable market share for the production of IC chips. This meant that for the first time the still-nascent U.S. semiconductor industry started feeling the realities of the competition-based market economy bearing down on them. In response the Semiconductor Industry Association(SIA), the organisation representing this industry in Washington D.C., decided on attempting to eliminate the culture of so-called chip piracy that had allowed their foreign competition to openly copy and reproduce the IC chips produced by U.S. firms. This was first attempted through copyrighting and patenting them, but eventually the SIA reached the conclusion that lobbying Congress for a new *sui generis* IP type was needed. It was through this initiative the Semiconductor Chip Protection Act(SCPA) of 1984 and its foreign equivalents came to be.

Almost 40 years later it can conclusively be determined that this effort was not successful. Japan, Taiwan, and South Korea have all become significant producers of IC chips. Collectively they hold a larger share of the market than any other region on Earth. Furthermore the E.U. has seen the rise of a domestic IC industry as well, though not one as significant as East Asia. The E.U. leadership has expressed a desire to increase efforts, however. Other countries have also gained importance in the industry, such as Israel and China. During those 40 years the laws have changed very little. However, this is not true for what those laws are meant to regulate. Integrated computer chips(IC chips) have evolved from a niche industry to one of geopolitical importance on par with hydrocarbons, mining, food, and clean water. Since the world has slowly become dependent on the internet, the use of which presupposes the use of IC chips, it might be interesting to revisit this initiative to see if it would fall into more fertile soil in the 21st century. This paper will seek to explore semiconductor IP protection, and answer the question: Is it, in light the geopolitical importance of its subject matter, worth reforming semiconductor IP legislation and the TRIPS Agreement in order to nurture the semiconductor industries of the 21st century?

Abbreviations

Dir	Directive
E.E.C.	European Economic Community
EPO	European Patent Organisation
E.U.	European Union
FoI	Freedom of information
IC	Integrated Circuit(s)
IP	Intellectual property
R&D	Research and Development
SCPA	Semiconductor Chip Protection Act 1984, Title 17 U.S.C. §§ 901-914
SIA	Semiconductor Industry Association
TFEU	Treaty on the Functioning of the European Union
U.K.	United Kingdom of Great Britain and Northern Ireland
U.S.	United States of America
WIPO	World Intellectual Property Organisation
WTO	World Trade Organisation
WW2	World War 2

1 Introduction

1.1 Background

The semiconductor industry is undergoing a paradigmatic shift.[1] The industry that only a few decades ago only drew the interests of industry-specific actors is now drawing the attention of the highest echelons of public officials, such as the U.S. President.[2] The reason for this is that the products of this industry have become components of almost every product sold on the consumer market. Infrastructures of significance, such as stock exchanges, automobiles, telephones, any type of software or audiovisual media, and many more are dependent on a readily available supply of them in order to function.[3] This has garnered integrated chips(IC chips) strategic importance on the geopolitical stage.[4]

An unusual aspect of this industry is that is has a *sui generis* form of intellectual property(IP), the semiconductor topography right, intended to protect it.[5] This makes the industry's legal landscape different, and presents opportunities for legal research. Since IP protection normally protects the interests of the producers of whatever the protected subject matter is, it can be presumed that the same is true in this case.[6]

1.2 Purpose and research question

The purpose of this paper is to explore the material contents of semiconductor topography rights legislation in a handful of countries globally. This is intended to provide a basis for explaining the unpopularity of these rights and how to address it.[7] The intention of the paper is also to offer a basic overview of changes needed to semiconductor IP regimes worldwide if the intention is to increase use of these rights.

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[1] Toumi, Illka: *The Future of Semiconductor Intellectual Property Architectural Blocks in Europe*, 2009. European Commission, Joint Research Centre, Institute for Prospective Technological Studies, Sevilla, Spain, p. 3-4.

[2] White House: Chips Act. (Retrieved 2023-01-02).

[3] Lojek, Bo: *History of Semiconductor Engineering*. 2007, Springer-Verlag Berlin Heidelberg, Berlin, Germany, p. 376-378.

[4] Csernatoni, Raluca: *Chasing Chips: A Geopolitical Puzzle*, 2021. Center for European Policy Analysis, Washington D.C., United States.

[5] Hoeren, Thomas: *Chip Protection in Europe*, 2004. Institute for Information, Telecommunication and Media Law, Münster, Germany, p. 1..

[6] Pila, Justine & Paul Torremans: *European Intellectual Property Law*, p. 5-17. 2nd Edition, 2019, Oxford University Press, Oxford, United Kingdom. Here a general discussion about the purpose and history of patents, copyrights and IP in general can be found.

[7] Callaway, Dan: *Patent Incentives in the Semiconductor Industry* in *Hastings Business Law Journal*, Vol. 4, 2008, UC Hastings College of the Law, San Francisco, California, United States, p. 140.

The research question is therefore as follows: “What changes to legislation are appropriate to make semiconductor topography rights more attractive for 21st century semiconductor producers to use?”

Determining success in making semiconductor rights useful for their holders could be done on the basis of their use in litigation, if consistency with the measure used in legal literature is desired.[8] Currently these rights see little use in court, which indicates that they offer so little gain that their owners choose not to protect them or even acquire them in the first place.[9] Theoretically, low use in court could also indicate that they a very strong, but that such a conclusion is inconsistent with the industry culture.[10] Nevertheless, this possibility exposes a weakness in that measure.

An alternative measure would be to measure the number of registrations in major economies such as the U.S., Japan, China and other major economies that require registration.[11] Seeking registration indicates actively seeking the protection and, considering the profits available on the markets of these nations, not seeking it would be financially irrational. This incentive means that by cross referencing the registers it would be possible to find the vast majority of topographies worldwide.

The two measures in combination could therefore offer a measure of the usefulness of the law. Assuming the suggestions of this paper are correct, implementation of suggested changes would be followed by an increase in registrations of semiconductor topographies and increased use of their underlying legislation in court.

1.3 Method

The methods used in this paper will be the legal dogmatic method, legal historical method, and a functional comparative. They will be used in no predetermined order or amount. They will be chosen on the basis of their suitability for any particular point being made.

The legal dogmatic method is the main research method of legal science. The method is, as the term “dogmatic” reveals, a method that operates within certain limits. These limits are the limits of the body of law. Usually what can be found withing these limits are the legal statutes, case law, preparatory works, and doctrine. The method is self-contained, meaning that

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[8] Callaway, p. 139-140.

[9] Radomsky, Leon: *Sixteen Years After the Passage of the U.S. Semiconductor Chip Protection Act: Is International Protection Working?* in *Berkeley Technology Law Journal*, Vol 15, 2000. University of California, Berkeley School of Law, Berkley, California, United States, p. 1085-1086.

[10] See section 2.4.

[11] See section 5 about registration requirements.

in and of itself it can lead to no conclusion that offers a path of action. It is purely descriptive of the law.[12]

The second method will be legal historical. This name of this method says everything that needs to be known about it. It is used to analyse the historical development of a law by following its passing, adoption, modifications, and use.[13] In the case of semiconductor topography rights this can be earliest in the second half of the 20th century, since before then the subject of regulation did not even exist yet. [14]

The third method used will be a functional comparative method. This involves comparing the different legislation and related matters in different jurisdictions.[15] In this paper this method will be applied to the national legislation that provides statutory basis for semiconductor topography rights in different jurisdictions. The comparison will be made on the basis of how the law functions.

1.4 Limitations

The there will be several areas from which this paper will be delimited.

The first delimitation is toward other areas of science. The reason for use or lack of use of semiconductor rights may be for reasons outside of the scope of law as a scientific discipline. An immediately apparent alternative source of such success or failure is within the field of economics. It can also explain the growth of the semiconductor industry. For example, the U.S. has the most heavily funded military in the world, and technological developments have many times been spin-offs from military projects.[16] The strong presence of the semiconductor industry in the U.S. could be explained by this just as well as the legal framework employed there. Essentially, the U.S may simply have out-invested everyone else and gained an advantage that way instead. Furthermore the traditional large conglomerates of East Asia, the *chaebol*, *keiretsu*, and Chinese state-owned corporations provide an alternative, more corporatist model for national economies that could potentially be better suited to domestic semiconductor industries than the competition-oriented model used in the U.S. and E.U.

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[12] Jareborg, Nils: *Rättsdogmatik som vetenskap*, 2004. *Svensk Juristtidning*, Vol. 1, 2004. (Swedish language publication. Translation available through machine translation if accessed here), 2004, p. 8.

[13] Peczenik, Alexander: *Juridikens teori och metod*, 2021. Lund University Faculty of Law, Lund, Sweden, (Swedish language), p. 50-51.

[14] The invention of the transistor was required for IC chips to even exist. See U.S. Patent no. 2,981,877, issued April 25, 1961: Monolithic transistor.

[15] Peczenik, p. 51.

[16] For example the internet itself was originally a U.S. Department of Defence project. Also, Bell Labs, where 1956 Nobel laureate Bill Shockley started his career as an entrepreneur, was primarily receiving contracts from the military. See Lojek, p. 11-15.

Since the study of these questions belongs firmly within the field of economics, not law, they will not be answered in this paper. However, should this paper prove to be of satisfactory quality as a source for such studies, those within professions with the required expertise are wholeheartedly encouraged use it for such purposes.

A second delimitation is the areas of the law that with all likelihood does not influence the choice of using them. There are such parts of semiconductor IP legislation, such as the question of implementing a system for a topography notice. This has no bearing on the usefulness of the law and therefore will not be discussed, even though there is disparity on this topic among different jurisdictions.[17]

A third delimitation will be toward legal philosophy. Due to the immaterial nature of semiconductor topography rights a discussion over the nature of IP rights' existence as independent of legislation is implicitly broached. This question is besides the topic of the paper, and therefore will not be addressed.

1.5 Materials

1.5.1 Availability of literature

The materials available on this topic are mostly from around the late 1990's and early 2000's. A search on Google Ngram, a service that allows for searching a full body of literature for certain phrases by year of publishing, reveals that mentions of the term "semiconductor topography" spiked in English language literature around that time.[18] Unsurprisingly, that time is when most literature on the topic that can be found from. The reason for this interest can be guessed at when taking into account how well it coincides with the so-called "dotcom bubble" of the late 1990's and early 2000's.[19] It also reveals the extent to which this legal area has been overlooked later. Later literature focuses more on the economic aspects of the semiconductor industry.[20] The reverse is true for earlier works, where emphasis is still put on the legal aspect of the topic.[21] This is probably due to the general levels of interest in different focuses on the topic. Perhaps once writers realised that the legal aspect did not particularly interest readers they moved to work

[17] Hoeren, p.10

[18] Google Ngram Search: semiconductor topography(Case insensitive search).

[19] There is a spike in the NASDAQ Composite Index around the beginning of 2000, which is when the dotcom bubble "burst". The NASDAQ Composite Index is weighted toward the technology sector. See Prableen Bajpai: What is the Nasdaq Composite, and What Companies are in It?, NASDAQ.com, 2021-05-12(Retrieved 2022-12-31).

[20] See for example Hall, Fink, and other later works referenced later in this paper.

[21] See for example Stern. Later works include Radomsky and Tuomi, but those have a noticeably economic lean in the focus.

on areas where interest was greater. This paper shall seek to make use both types of materials, most of which are research papers, scientific articles, and other shorter materials to construct a full image of where matters stand. The legal framework that is found in this manner will be analysed in the current technological context, thereby aiming to see where the law could be improved for IC chip producers.

1.5.2 Reservation for translations

Legislation not originally in English or Swedish have, due to linguistic shortcomings on part of the writer, been translated to English using machine translation offered by the Google Chrome browser. For this reason the accuracy of these translations cannot be guaranteed to hold up to scrutiny in the original language. Due to the lack of official translations and better translating options these will be used anyway. In the cases an official translation was available it was used. Links are provided in the text to the version used. If the linked version is in English that translation was used. If it is another language the linked text was translated using machine translation.

1.5.3 Reservation concerning the legal status of the islands of Taiwan, Penghu, Kinmen and Matsu

The topic of this paper requires the author to address the local legislation currently being enforced on the islands of Taiwan, Penghu, Kinmen and Matsu(collectively called Chinese Taipei)[22]. These islands have not declared independence as a sovereign state, but *de facto* operate independently from the People's Republic of China. The People's Republic of China claims sovereignty over these islands and maintains that there is only one legitimate government, the one based in Beijing.

This paper does not seek to address the topic of Chinese Taipei's legal status. Any and all parts of the text that may be read as to contain any opinions or statements of fact on this topic have been written in such a manner inadvertently and without intention to express or imply such opinions or statements of fact. The topic of the paper requires that the rules enforced in Chinese Taipei be described and analysed and the paper will limit itself to that.

[22] This is how this entity is referred to at the WTO, where it has its own representation. In the spirit of remaining neutral this term was used here as well.

The entity currently *de facto* in control of Chinese Taipei will be referred to in the text as Taiwan and Taiwanese. The rest of China will be referred to as China and Chinese.

2 Important aspects of semiconductor industry

2.1 The basics of IC chips

IC chips are made out of so-called semiconductors.[23] Semiconductors are materials which conduct electric currents only when subjected to certain conditions, such as heat, electrical currents, or proximity to magnetic sources. This can be used to create a device in which a circuit made of these materials constitutes a “switch” which is “flipped” by introducing the conditions that make it conductive. This is known as a transistor. If transistors are grouped together, and assigned values through binary numerical systems, information can be stored or processed in these groups. By changing which transistors are “flipped” the information can be added to, changed, or removed. Modern IC chips can do this at a rate of billions of changes per second.[24]

IC chips are tremendous amounts of microscopic transistors made on the same surface. This way one of these chips can carry out equally tremendous amounts of logical operations near-instantly. The way the transistors are arranged on the chip, the topography of the chip, is an important part of its functioning. Its performance is directly correlated with the number of transistors it houses, increasing raw computing power. Also, certain ways of arranging transistors can make the chip suited to different tasks, such as memory storage or processing.[25]

The important part to know for the purposes of this paper is that IC chips are made from specific materials, usually the semiconductive elements silicon and germanium. They can be produced with different production methods, but all methods require a template in the so-called “wafers” that make them. It is also important to know that there are several stages to their production. Lastly, their topographies are arranged into conductive and isolating layers which are grafted together. The arrangement of these layers are interdependent, meaning that adjacent layers must be suit one another.[26]

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[23] Encyclopaedia Britannica: Integrated Circuit (Retrieved 2022-12-02).

[24] Encyclopaedia Britannica: Transistor (Retrieved 2022-12-02).

[25] Encyclopaedia Britannica: Transistor (Retrieved 2022-12-02).

[26] Kukkonen, Carl A.: *The need to abolish registration for integrated circuit topographies under TRIPS* in *The Journal of Law and Technology,* Vol. 1, 1997. University of New Hampshire, Franklin Pierce School of Law, Concord, New Hampshire, United States. There are mentions of the legally relevant aspects of IC chip topographies throughout the paper. It is first discussed on p. 112.

2.2 High level of investment into research

IC chips are produced by the semiconductor industry. In order to develop a new IC chip high levels of investment into research and development(R&D) are needed. The microscopic nature and sheer amount of the transistors mean that scientific breakthroughs are required in order to obtain an IC chip that is better than anything already on the market. This dynamic can clearly be seen in the semiconductor industry today. Its success and initial growth coincides with the massive investment into R&D that characterises the post-WW2 U.S. economy, which is indicative of the nature of investment required by the industry.[27]

The production of these chips is very capital and technology intensive. Production of computer chips requires dust free, controlled environments, cutting edge technology, and comparatively low amounts of labour in relation to the value produced.[28] This means that capital support for inventing new technologies is essential, meaning that R&D costs are unusually high for a competitive company in the IC chip production industry compared to other industries.

2.3 Extensive use of patents

Due to the highly technology based nature of the industry there is a great need to protect the competitive edge of the companies gained through technological advancements. This shows in the statistics over the large increase in patent filings worldwide over the last few decades. In the period 1995-2008 the total growth in first filings was 46.1%. Of this increase "Computer technology" represented 5.0%, "Electrical machinery, apparatus, energy" 3.1%, "Digital communication" 3.0%, and "Semiconductors" 2.3%. Together these categories occupy 4 out of 5 top-5 spots on the level of contribution to increases in patent filings. The fifth category this growth was mainly driven by was pharmaceuticals, which was probably due to the advent of pharmaceutical patents enabled by the Hatch-Waxman Act of 1984 and its international equivalents.[29] These figures indicate that semiconductors and technologies dependent on them represent an outsized part of the increase in patent filings worldwide, which in turn indicates

[27] Lojek, p. 376-378.

[28] Miller, Joe: *Europe's new €1.6bn chip plant needs only 10 workers on factory floor*, Financial Times, 17-07-2021.(Retrieved 2022-12-31).

[29] Hall, Bronwyn: *Exploring the Patent Explosion*, 2004 in *Journal of Technology Transfer*, Working paper 10605, National Bureau of Economic Research, Cambridge, Massachusetts, United States, p. 4, 20.

heavy use of IP law in the semiconductor industry and the industries that depend on it.[30]

The use of patents in particular likely has to do with the fact that the ever-present problem of fitting more transistors onto the same surface requires the industry push the limits of available technology, i.e. create novel technical solutions to a problem. This is close to the definition of an invention found in patent law.[31] The fact that patent law grants an advantage in the market for the period of patent protection is an added bonus which makes this all the more desirable for the semiconductor industry.

2.4 Low level of respect for intellectual property

Intense use of IP rights is not without its own set of problems, however. The technical complexity of the industry and the sheer amount of patents used means that it is almost inevitable that one company infringes on the patents of another.[32] This has led to an industry culture where companies licence their IP portfolios wholesale rather than individual IP rights or try to "fly under the radar", i.e. knowingly infringe patents or wilfully neglect to carry out due diligence in regards to prior art and hope the IP owner does not catch them doing it and demand compensation. Cross-licencing agreements are common as well, where a company allows the use of their patents wholesale in exchange for permission to do the same from the other party. The current state of the semiconductor industry is geared toward these solutions, which entrenches a lax attitude toward IP rights. The technology is too complex, the possible gains too small, and the burden of proof too difficult to overcome to engender any desire to change this.[33]

The low level of respect for IP is made worse by the risk of so-called "holdups". This is a situation when IC manufacturers discover too late that the technology included in their designs is protected under someone else's patents. When faced with holdups they must choose between redesigning their product, paying for licencing, or cancelling production. In other words,

[30] Fink, Carsten, Mosahid Khan, Hao Zhou: *Exploring the Worldwide Patent Surge*. 2013, WIPO Economics & Statistics Series, Department for Economics and Data Analytics, Genève, Switzerland, p 16-18.

[31] See Articles 52-57 of the European Patent Convention or Article 27(1) of the TRIPS Agreement.

[32] While this raises the question of whether a patent really was non-obvious, it is incumbent on the competition to challenge the grant on that basis. This carries with it that this course of action is risky by default, a consideration when choosing legal strategies.

[33] Callaway, p. 135-137, 142-144.

there are no good options.[34] There have been efforts by U.S. courts to ease the problem of holdups by setting a different standard for the duty of acting with care in cases of wilful infringement.[35] This reduced the need to keep engineers from studying patents in order to keep them “untainted”, thereby reducing the counterproductivity in the patent system holdups give rise to.[36] In the case of semiconductor rights there is even a statutory exemption for this particular problem, known as the innocent infringer exception.[37] Nonetheless, holdups remain a problem in the area of patents, since non-punitive damages are still available for those seeking damages for inadvertent infringement of patents.[38] There have also been doubts within the semiconductor industry whether obtaining IP protection is worthwhile at all, considering the pace of development renders technology obtained through IP infringement obsolete faster than it could be used to capture any significant profits reserved for the owner of said IP.[39]

2.5 Possible future technology

2.5.1 The pace of change

Recent history would tell us that the stuff of science fiction and the far future are sometimes actually just about to be invented.[40] Given this it is worth mentioning some of the directions technology seems poised to be taking humanity down in the coming decades. Technological developments can either spell the end of the semiconductor topography IP, bring about a second renaissance for it, or take it into new territory altogether. Below three current trends will be listed that represent each of these possibilities.

2.5.2 Quantum computing

Quantum computing relies on the use of computational technologies that upends one of the most basic pillars of transistor-based IC technology, binary information storage. Quantum computers instead use the mechanics

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[34] Shapiro, Carl: *Navigating the Patent Thicket: Cross Licenses, Patent Tools and Standard Setting*, in Jaffe, Adam, Josh Lerner, Scott Sterner: *Innovation policy and Economy 1*, 2000. MIT Press, Cambridge, Massachusetts, United States, p. 124-126.

[35] *In re Seagate Tech., LLC,* U.S. Federal Circuit Court Southern District of New York, 2007.

[36] Callaway, p. 143-145.

[37] Article 36 of the TRIPS Agreement contains “*…or an article incorporating such an integrated circuit only in so far as it continues to contain an unlawfully reproduced layout-design*” which protects defendants from retroactive infringement claims.

[38] The discussion found in Callaway, p. 143-145 is on whether damages awarded can be of the enhanced type. The awarding of damages *per se* is never called into question by Callaway.

[39] Radomsky, p. 1076-1077.

[40] Gene Roddenberry’s Star Trek franchise from 1966(Original Series) offers snapshots of things that were considered such technological wonders at the time that they might as well have been magic. Many of these things exist today and are commonly used, such as video calls, GPS, biometrics, mobile phones, voice-activated software, and more.

of quantum physics to generate values between 1 and 0, thereby greatly increasing the calculational power of computers on the most basic level.[41]

What quantum processors will look like might make the entirety of semiconductor topography IP legislation obsolete, or it may be just as applicable to that as to currently used technology. It depends whether they conform to the layering, production, and material framework used in the definition of the protected subject matter in current law. It is important that legislation is kept relevant, and semiconductor topography rights might be in need of major reforms if quantum computing starts being used on a larger scale.

2.5.3 ASICs

ASIC stands for Application Specific Integrated Circuit, meaning IC chips that can only be used for their intended purpose. These are poised to play a larger role in the IC chip market, thereby possibly staking a out a future where computer technology will be specialised to a greater degree than today.[42]

The so-called internet of things, where everyday items will be connected to the internet for one reason or another, will probably be a great driver of this development. This would presumably also drive demand for a *sui generis* IP regime protecting the IC chips used. This trend might therefore result in an upswing in semiconductor topography IP use.[43]

2.5.4 Natural barriers to chip piracy

There have been commentators that claim that the increasing cost and complexity that goes into making new chip topographies reduces the problem of chip piracy without naturally.[44,45]

Obviously such development would render semiconductor rights wholly redundant. There is no reason to expend time and resources on legally imposing sanctions on copying something that is impossible to copy anyway. This development makes the *sui generis* semiconductor IP less useful as technology advances.

[41] Encyclopaedia Britannica: Quantum Computer.

[42] Toumi, p. 119-121 mentions that "there will be increasing demand for chip designs that are optimised for the problem at hand" which clearly is a nod towards ASICs.

[43] Encyclopaedia Britannica: Internet of Things.

[44] Radomsky, p.1077.

[45] Kasch, Steven: *The Semiconductor Chip Protection Act: Past, Present, and Future* in *High Technology Law Journal*, Vol 8, 1993. Suffolk University Law School, Boston, Massachusetts, United States, p. 97.

3 History of the semiconductor industry

3.1 Invention of the IC chip

The first question that arises in regards to the history of the semiconductor industry is "When does it begin?" A date of great importance is July 30, 1959, when the patent for the solid state transistor, the technology that gave rise the industry, was filed in the name of Robert N. Noyce, a co-founder of the U.S. Fairchild Semiconductor Corporation.[46] There are of course inventions and inventors that laid the ground work for this invention that deserve mentioning as well, such as Jack Kilby of Texas Instruments and 1956 Nobel laureate Bill Shockley of Bell Laboratories.[47] Their inventions in combination with Noyce's started the trend in computing technology that since then improvements have largely revolved around: miniaturisation. This means making a ever-increasing number of transistors fit on the same surface area. The now-famous Moore's Law, an observation by Gordon Moore, another co-founder of both Fairchild and later Intel, states that every two years the surface area required for the same amount of transistors will halve. This has held up as a rule of thumb so far(02-31-2023).[48]

3.2 Early dissemination of knowledge and U.S. dominance

As mentioned in section 2.4, the intellectual property situation in the semiconductor industry is difficult to navigate without being faced with either financial loss, significant effort, or being drawn into litigation.[49,50] This has been a problem since the early days of the semiconductor industry. During the earliest paradigms of the industry, of which for example Fairchild was a part, the persons involved in the industry would often switch employers or found their own firms, taking their knowledge with them. It was not uncommon that this knowledge was the key to the success of the company.[51] Fairchild Corp. itself provides an excellent case study on this. It never recovered from the losses of key personnel it suffered toward the end of its existence as an independent firm.[52] A contributing factor to these

[46] U.S. Patent no. 2,981,877, issued April 25, 1961.
[47] Lojek, p. 150 contains a schematic view of all the prior art on which Noyce improved with his invention.
[48] Lojek, p. 7-8 .
[49] Callaway, p. 142-143.
[50] Toumi, 49-52.
[51] Callaway, p. 135-138.
[52] Lojek, p. 155-174.

levels of staff turnover was that almost the entire industry was located in the U.S., usually the east coast or California. Fairchild, for example, was in California. One of Fairchild's spin-offs, Teledyne, established headquarters down the road from Fairchild headquarters in a flagrant attempt at poaching staff from Fairchild, which had entered its final decline by then.[53] As exemplified by Fairchild, disloyal staff, difficult managers, and other staples of office politics were often what drove changes in staffing.[54] The prospect of the great wealth that the owners of successful semiconductor companies often came into likely did its part as well.[55]

In addition to the difficulties many companies had in keeping key staff from leaving for the competition there was also a general resignation to the idea of patents due to the prevalence of so-called "patent thickets".[56] The pace of development in the semiconductor industry was tremendous, yielding patentable inventions at a staggering rate. This meant that a company in the industry could possess patents on hundreds of components that quickly became ubiquitous as their usefulness was made apparent industry-wide. Wielding such IP portfolios many companies had the ability to halt the operations of many of their competitors by enforcing their patent rights. However, this would not have been in their interest, since they would have been met with the same treatment. Consequently most companies chose not to risk it and patents went unenforced.[57]

In an environment shaped by staff poaching and tacit agreements to not enforce IP a culture of ignoring or foregoing IP developed during the semiconductor industry's infancy. Policies such as wholesale cross-licensing became a common practice for companies to "keep their backs clear" should any competitor decide to adopt a more aggressive stance.[58,59]

3.3 Spread beyond the U.S. and the end of the "Wild West" period

The widespread lax disposition toward IP in the early days of the industry started to shift when foreign competition increased. Price dumping by Japanese producers in the 1980's increased the competitive pressure on the U.S., leading to businesses and politicians noticing that foreign competition was a serious threat to the viability of U.S. firms. There was even talk of an "economic war" being fought between the U.S. and its competitors. It was

[53] Lojek, p. 180.
[54] Lojek, p. 89-95, 155-165.
[55] Lojek , p. 282.
[56] Shapiro, p. 120-122.
[57] Callaway, p. 137 .
[58] Shapiro, p 120-122.
[59] Callaway, p. 137.

felt that the dominance of the U.S. was being lost to the economies of East Asia.[60] The Japanese in particular caught the ire of the Americans, because they were perceived to be exporting from a market that did not allow foreign imports, thereby artificially creating an advantage for their own industries.[61,62] At the time the WTO had not yet been established, meaning that the average national trade policy had the potential for a greater degree of unilateral and protectionist policy under the old GATT rules.[63]

It was found that in addition to abusing unfair competitive rules the foreign competition was also engaged in so-called "chip piracy". "Chip piracy" is when one company buys the IC chip made by another company in the consumer market and proceeds to copy their IC chip topography by way of deconstructing one of their chips and creating an identical template. This template can then be used to produce identical chips undercutting the original producer's pricing, since the development costs have been avoided, recoup them as part of the product price is not needed.[64,65]

The different members of the U.S. SIA(Semiconductor Industry Association) first attempted using copyrights and patents in order to fight back against "chip piracy", but these attempt proved futile. In response they launched a lobbying effort in Congress which resulted in the creation of a new *sui generis* IP form of protection, the semiconductor topography right, through the Semiconductor Chip Protection Act(SCPA) of 1984.[66]

3.4 Introduction of SCPA in the U.S.

The idea to introduce the SCPA was conceived after the U.S. IP authorities had denied all other forms of protection. Applications for copyrights and design patents(elsewhere a.k.a. design rights) were denied by the U.S. Copyright Office because of the utilitarian nature of mask works.[67,68] Patenting of integrated circuitry as inventions was not viable due to the complexity of the integrated circuits, meaning a patent examination process would take longer than the commercial lifetime of the chip would last.[69] Furthermore, simply by arranging microscopic components in a different layout the novelty requirements employed in patents could not be reached.[70]

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[60] Toumi, p. 79-80.

[61] Lojek, p. 171-174.

[62] Kasch, p. 78-79.

[63] The WTO was created in 1995 at the end of the so-called Uruguay Round of trade negotiations. These took place between 1986 and 1995. Read more at the WTO website here.

[64] Callaway, p. 139.

[65] Kukkonen, p. 106.

[66] Callaway, p. 138.

[67] Kukkonen, p. 107.

[68] Radomsky, p. 1055.

[69] Kukkonen, p.107.

[70] Kukkonen, p. 107.

Finally, trade secret protection would be made useless by putting the IC chips on the commercial market, where competitor can buy them and thus learn these secrets.[71] Thanks to the development of new technology a gap between the available *sui generis* IP types was therefore found to have arisen.

In response the SIA lobbied for the SCPA to be passed by the U.S. Congress in 1984.[72] The SCPA specifically protects the templates for IC chips, thereby circumventing the problems that did not allow for copyright or patent protection.[73] It also contains a so-called principle of reciprocity which allows the U.S. president to extend protection to foreign chip designs, provided that U.S. ones are granted equivalent protection in the country of its origin.[74] This way the law was also suited for combatting the unfair competitive rules the SIA felt its members were being subjected to. Leveraging access to the U.S. domestic consumer market, the most lucrative in the world at the time, was a strategy that served the U.S. well in the second half of the 20th century, so there was nothing novel about this approach.[75,76]

However, the law met with limited use and was first used in litigation in the case of *Brooktree v. AMD*. By 1992 this was still the only published case where the law had been litigated.[77,78]

3.5 International influence of the SCPA

Various other jurisdictions adopted SCPA-compliant legislation throughout the 1980's to the 2000's, thereby securing themselves IP-protected access to the U.S. consumer market. It is when the SCPA is passed that the relevant historical context leaves the confines of the U.S. borders. Since the U.S. domestic consumer market was one of the largest and most lucrative in the world at the time, the SCPA's reciprocity provisions, started a race against time among those seeking to keep exporting products containing IC chips into the U.S.[79,80]

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[71] Kukkonen, p. 108, Callaway, p. 140-141.

[72] Callaway, p. 139.

[73] See more in section 4.1.

[74] 17 U.S.C. § 902(a)(2), 17 U.S.C. 914.

[75] Friedman, George: *The next 100 years: A forecast for the 21st century*. 2010, Anchor Books Publishing, New York, New York State, United States, p. 24-30.

[76] Hoeren, p. 1.

[77] Kasch, p. 72.

[78] See more in section 4.6.

[79] Hoeren, p. 1-3.

[80] See more in section 4.11.

- The E.U. hastily[81] adopted Directive 87/54/EEC in 1986. This in turn was implemented by the various member states later on. Important examples include 1987(Germany and the Netherlands), 1989(UK), and 1992(France and Sweden).[82]

- South Korea and Japan were the nations the SIA was most keen on reining in.[83] They adopted legislation protecting IC topography in 1985(Japan) and 1992(South Korea).[84]

- Other countries of interest for this paper introduced their equivalents to the SCPA in 1999(Israel), 1995(Taiwan), and 2001(China).[85]

The international influence of the SCPA was eventually set down in the 1994 TRIPS agreement, where it can be found in Articles 35-38. Semiconductor topography rights originally were intended to have their own international treaty, the 1989 Washington IPIC Treaty, but this was superseded by the TRIPS agreement after the Washington treaty failed to garner ratification.[86] The TRIPS Agreement mostly restates the Washington Treaty, and introduces few major changes. The most significant changes made to the length of the protected period and the specifics of its start.[87] This way the Washington Treaty has gained new life and has gone into force if not in theory then mostly in practice. An interesting note is that for this reason the WTO and not the WIPO is the international organisation that has had the most success in introducing semiconductor topography IP rights among the international treaties. This is because the WIPO's failure was concurrent with the Uruguay rounds of negotiations to found the WTO. Those negotiations mainly took part between 1986 and 1995.[88]

3.6 The geopolitical dimension emerges

After the introduction of the TRIPS Agreement there have been no major legislative initiatives relating to semiconductor IP in particular. However, there have been changes to the circumstances under which the industry operates. In the 1980's and 1990's, when the SCPA was still new, there was already an interest in the computer industry similar like today, but the world economy did not yet depend on computer technology the way it does now.

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[81] Hoeren, p. 2.

[82] See laws in section 5. France and Sweden have both made important reforms on this topic. Sweden made a new law in 1992 to replace one that was not directive-conform, and France has replaced their IP code in 2020.

[83] Hoeren, p. 2 .

[84] See laws in section 5.

[85] See laws in section 5.

[86] Karnell, Gunnar: *Protection of Layout Designs(Topographies) of Integrated Circuits – R.I.P?* in Karnell, Gunnar: *Äras Dem som Äras Bör!*, 2018. eddy.se AB publishing, Visby, Sweden, p. 430.

[87] See Art. 38 TRIPS and Art. 8 of the Washington Treaty.

[88] WTO.org: Understanding the WTO: Basics: The Uruguay Round (Retrieved 2023-01-31).

For example, mail was still on paper, the bank still operated through the teller at the bank office, shops operated with cash almost exclusively, and "googling" was done in books and libraries.[89] Now the mail is email, the bank is online, the shops take card payment, and books and libraries are competing with Google *et al*.[90,91]

This change has been gradual and driven by the efficiency and convenience offered by the computerised solution. However, using a computerised solution to everyday tasks creates a dependence on IC chips, since electronic equipment requires them to function. This means that in the nearly four decades since the passing of the SCPA the world has grown to depend on IC chips, and access to them has become a matter of critical importance. This importance is arguably on a similar scale as access to hydrocarbons, food, water, steel, copper and other important resources, meaning that a developed national economy is no longer possible without them. For this reason domestic production of IC chips has become a matter of national security.[92,93]

It is with this background that the new U.S. CHIPS Act and the E.U. CHIPS Act came about. Both are primarily intended to engender the growth of a domestic semiconductor industry. They offer financing, development opportunity, skilled staff and many other things needed for the industry.[94,95] However, changes to IP legislation, despite sharing their core purpose, growing the semiconductor industry, are conspicuously absent. The SCPA and its foreign equivalents sought to protect a U.S. industry against what the industry considered unfair foreign competition. The CHIPS Acts seek to establish domestic industries due to important national interests that are not necessarily economic. Thus the two sets of laws differ in their underlying motivation, but not in the intended objective effect, the growth of a domestic semiconductor industry.[96,97,98]

In light of this it would seem worth asking whether changing IP legislation might also be worthwhile in pursuit of that goal. While the SCPA had protecting the semiconductor industry at home as its *end* purpose, the CHIPS Acts are only a part of the larger struggle to maintain the upper hand in the geopolitical arena.

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[89] Anecdotally, it can be noted that "The Simpsons", which aired first 1989 only sporadically depicted computer technology until its later seasons, thus providing a series of snapshots of everyday life in the U.S. in the late 20th century and how computer tech changed it.

[90] Lojek, p. 375-379.

[91] Radomsky, p. 1051.

[92] Lojek, p. 375-379.

[93] White House: Chips Act(Retrieved 2022-12-31).

[94] E.U. Commission: European Chips Act(Retrieved 2022-12-31).

[95] White House: Chips Act(Retrieved 2022-12-31).

[96] E.U. Commission: European Chips Act(Retrieved 2022-12-31).

[97] White House: Chips Act(Retrieved 2022-12-31).

[98] Radomsky, p. 1053.

4 Legal framework

4.1 Introduction to legal framework

Examination of the legal basis for semiconductor topography rights would originally have started with the law that first enshrined them, the 1984 U.S. SCPA. This is because, as explained in the previous section, the SCPA was the first among all similar legislation in other countries. However, since then the TRIPS Agreement has come into force, which creates an interesting field of study.

The SCPA and its equivalents are IP legislation, which means that certain topics must be addressed due to their core importance to IP legislation. Examples include the definition of the protected subject matter, standard of originality, term of protection, exhaustion of rights, exceptions to protection, sanctions, etc. In addition to this there might be questions that are unique to this law in particular, such as the previously mentioned principle of reciprocity.

4.2 Protected subject matter

The protected subject matter of the different IP laws is internationally regulated by the Article 35 of the TRIPS Agreement, which in turn refers back to the Washington Treaty. The TRIPS agreement incorporates Articles 2-7, except Article 6(3), 12 and paragraph 3 of Article 16 of the Washington treaty.

There are two categories of commonly used terms for the protected subject matter. The one that the U.S. SCPA uses, “mask works”, refers to the templates used to create the semiconductors with the topography in need of protection. The other is one where the “topography”, “layout”, “layout-design”, or something to that effect itself is the protected subject matter.[99] The latter is used by most countries other than the U.S. See further discussion and the rules themselves below.

[99] Hoeren, p. 3.

SCPA version	E.U. Dir. version	Washington Treaty
"a "mask work" is a series of related images, however fixed or encoded—	*"The 'topography' of a semiconductor product shall mean a series of related images, however fixed or encoded;*	*"layout-design (topography) means the three-dimensional disposition, however expressed, of the elements, at least one of which is an active element, and of some or all of the interconnections of an integrated circuit, or such a three-dimensional disposition prepared for an integrated circuit intended for manufacture"*[102]
(A) having or representing the predetermined, three-dimensional pattern of metallic, insulating, or semiconductor material present or removed from the layers of a semiconductor chip product; and	*(i) representing the three-dimensional pattern of the layers of which a semiconductor product is composed; and*	
(B) in which series the relation of the images to one another is that each image has the pattern of the surface of one form of the semiconductor chip product;"[100]	*(ii) in which series, each image has the pattern or part of the pattern of the surface of the semiconductor product at any stage of its manufacture;"* [101]	

[100] 17 U.S.C. § 901 (a)(2).

[101] Art. 1(b) Directive 87/54/EEC.

[102] Article 2(ii) Washington IPIC Treaty.

What is immediately apparent is that the version the E.U. and the Washington Treaty are using is more technology-neutral compared to the U.S. version. The U.S. version of the definition defines the “mask work” templates rather than the topography itself as the protected subject matter. This means that topographies *per se* are not protected under U.S law. Instead the templates that are used to make them are protected.[103] While this distinction may seem trivial at first it has gained importance in the latter years of semiconductor IP protection, since the manufacture of mask works has been automated and alternative methods of production are now available. The U.S. legislation has arguably become obsolete as a consequence.[104,105] The countries that use the other category of terms also have considerable variations on the definition of the protected subject matter, even though they all have a broader definition than the U.S. thanks to allowing other methods of production. These differences include the materials the topographies incorporate, the layers of the topography, production methods, and different stages of production.[106,107,108]

There might be many reasons to differentiate from other countries in regards to making the definition wider or more narrow. Good reasons for making it wider could be a desire to accommodate future technology or to encourage domestic establishment of the semiconductor industry to a greater degree than other countries. Reasons for narrowing it down could be a desire to avoid abuse, avoid overlaps with other IP types, or scepticism toward semiconductor rights as *sui generis* IP rights. It is also more likely than with other legislation that the legislators did not have proper grasp of the topic. The technology was less than 30 years old at the time of passing the SCPA, and its intricacies were hardly common knowledge at the time. Even now, decades later, the productions methods for IC chips can hardly be considered common knowledge despite having a paradigm-shifting effect on the world economy.

[103] Hoeren, p. 3.

[104] Radomsky, p. 1057 footnote 29.

[105] Kukkonen, p. 112.

[106] Examples: Radomsky, p. 1066-1070.

[107] Examples: Kukkonen, p. 112, 118, 120, 122, 126.

[108] The layout of the individual layers of a topography place limits on the possible layout of adjacent layers, thereby rendering the protection of individual layers arguably superfluous. See Radomsky, p. 1068.

4.3 Exclusive rights

The exclusive rights conferred by the SCPA and all other laws protecting semiconductor topographies have a minimum standard in Article 36 of the TRIPS Agreement:

> "*...Members shall consider unlawful the following acts if performed without the authorization of the right holder: importing, selling, or otherwise distributing for commercial purposes a protected layout-design, an integrated circuit in which a protected layout-design is incorporated, or an article incorporating such an integrated circuit only in so far as it continues to contain an unlawfully reproduced layout-design.*"[109]

It can be seen that the exclusive rights conferred on the owner of the semiconductor rights are typical for industrial IP, for example patents.[110] However, it should be noted that Article 36 of the TRIPS Agreement does not confer as many exclusive rights as copyrights or patents.[111] This is interesting considering that the TRIPS Agreement incorporates Article 6 of the Washington Treaty, which also grants the exclusive right of reproduction. The text of Article 6 of the Washington Treaty does not contain the last clause "*…or an article incorporating such an integrated circuit only in so far as it continues to contain an unlawfully reproduced layout-design*" from Article 36 of the TRIPS Agreement. This an update to the international rules like the increase of the protected period in Article 38, but this one was intended to allow for temporary infringements necessary for production.[112]

Consequently all national legislation includes at least three exclusive rights. The rights to reproduce, the rights to import, and the right to distribute through sales or otherwise for commercial purposes. For example, the U.S. SCPA reads:

> "*The owner of a mask work provided protection under this chapter has the exclusive rights to do and to authorize any of the following:*
>
> *(1)to reproduce the mask work by optical, electronic, or any other means;*[113]

[109] See Article 36 TRIPS Agreement.
[110] See Article 28 TRIPS for what rights are conferred by patents.
[111] See Article 9, 28 of the TRIPS Agreement and Article 5 of the Berne Convention.
[112] Radomsky, p. 1074-1075.
[113] Primary infringement. Footnote added as note, original legislation does not contain it.

> *(2)to import or distribute a semiconductor chip product in which the mask work is embodied;*[114] *and*
>
> *(3)to induce or knowingly to cause another person to do any of the acts described in paragraphs (1) and (2).*"[115]

Other countries generally hold themselves close to the minimum, but there are a few exceptions, such as the Dutch not requiring commercial purpose for exclusivity.[116,117]

4.4 Standard of originality

4.4.1 Introduction to originality

The standard of originality, the level of novelty and creativity that is required in order to be given protection under the SCPA, that applies to semiconductor in the U.S. is derived *e contrario* from 17 U.S.C. § 902 (b). Reading this *e contrario* is supported in this particular case by Article 35 of the TRIPS Agreement pointing to Article 3(2)(b) of the Washington Treaty, where this conclusion is stated explicitly.

Consequently, in order to receive protection under U.S. law the mask work must be original[118] and not consist of

> "*designs that are staple, commonplace, or familiar in the semiconductor industry, or variations of such designs, combined in a way that, considered as a whole, is not original*."[119]

The requirement of originality was inspired by copyright law, which has similar characteristics when it comes to the protected subject matter being identified on the basis of its appearance. There were attempts a copyrighting the topographies before the SCPA was introduced, and they were rejected with the argument their purpose was utilitarian and not artistic.[120] While this lead to the effort being unsuccessful, it had no bearing on the bar that needs to be cleared concerning originality, only purpose. Logically, this would mean that semiconductor topography rights therefore have the same standard of originality as copyrighted artistic works, with the difference that semiconductor rights apply to utilitarian layouts and only in the context of

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[114] Secondary infringement. Footnote added as note, original legislation does not contain it.
[115] 17 U.S.C. § 905.
[116] Hoeren, p. 5 footnote 20.
[117] See section 5 for details.
[118] 17 U.S.C. § 902 (b)(1).
[119] 17 U.S.C. § 902 (b)(2).
[120] Kukkonen, p. 107-109.

IC chips. This conclusion is supported in the literature, with the caveat that the technical restrictions on the appearance of IC chip topographies place the standard of originality slightly higher.[121] Thus, if a semiconductor topography was meant to be a work of art it would have received copyright protection, barring that difference.[122]

The requirement in 17 U.S.C. § 902 (b)(2) also requires novelty. This is a departure from copyright law.[123] The rule requires that prior art, registered or otherwise, is taken into account if it is "*staple, commonplace, or familiar*" within the industry. The precise meaning of this was to be decided on a case-by-case basis. This part of the law is more akin to patent law, where the prior art may preclude protection even if has not yet been infringed, which would follow by necessity in the case of copyrights.[124] This conclusion is also supported by the fact that the SCPA is industrial property IP law, and therefore has more in common with patent law in regards to its purpose than copyright law. It does consequently not protect every single creation as soon as any level of originality manifests, the way that copyright law does. Instead there is a requirement for a higher minimum level of creative progress, similar to patents requiring the invention to be non-obvious.[125]

The international treaties have a very similar definition of this requirement. The Washington Treaty states that:

> "*... shall apply to layout-designs (topographies) that are original in the sense that they are the result of their creators' own intellectual effort and are not commonplace among creators of layout-designs (topographies) and manufacturers of integrated circuits at the time of their creation.*"[126]

Therefore it is reasonable to assume that the same logic from the SCPA also flows through the treaties into the other laws.

4.4.2 Works of combination

[121] Stern, Richard H.: *Determining Liability for Infringement of Mask Work Rights under the Semiconductor Chip Protection Act*, in *Minnesota Law Review*, Vol. 70, 1985. University of Minnesota Law School, Minneapolis, Minnesota, United States, p. 316-319.

[122] It is interesting to explore when technical schematics are used by artists as works of art. For example the piece *Propeller* from 1937 by Sonia Delaunay clearly depicts schematics of an aeroplane engine, but is at the same time a work of art and thus subject to copyright. Could the same be done with a stylised IC chip topography? After all, the drawings of IC topographies were granted copyright protection. See Kukkonen, p. 107.

[123] Stern, p. 316-318.

[124] Stern, p. 316-319. See in particular footnote 156 for a more in-depth discussion, where the preparatory works are mentioned.

[125] Stern, p. 316-319.

[126] Article 3(2) Washington Treaty.

There is a detail that is worth of observing in regards to the standard of originality, which is that so-called “works of combination” are eligible for protection under the SCPA if they constitute an original and novel combination as a whole. This is common for many types of IP, for example parodies in copyright, or new inventions building on old technology in patents, etc.[127]

In the area of semiconductor chips this is made possible through acquiring protection for topographies that are combinations of other topographies that would in and of themselves do not clear the requirements for originality or novelty. The text of the law that supports the doctrine of works of combination can be found at the end of 17 U.S.C. § 902 (b)(2), where the text of the statute reads “*variations of such designs,* combined *in a way that, considered as a whole, is* not original”(italic removed for emphasis).[128] This must be read *e contrario* to mean that works of combination that in fact are original are eligible for protection.

The international conventions on this particular detail regulate this under the referral of the TRIPS Agreement to Article 3(2)(b) of the Washington Treaty in Article 35. The Washington Treaty states that:

> “*A layout-design (topography) that consists of a combination of elements and interconnections that are commonplace shall be protected only if the combination, taken as a whole, fulfills the conditions referred to in subparagraph (a).*”[129]

The importance of allowing works of combination to be protected has increased with time. The increasing costs associated with producing new chips have left most of the industry dependent on using old technology, but in new ways.[130] Without allowing works of combination to receive protection the novelty and originality requirements under semiconductor IP legislation would likely have been insurmountable at this point.

4.5 Period of protection

The period of protection that was originally intended for semiconductor topography rights was 8 years, as can be seen in Article 8 of the Washington Treaty, where it states that “*Protection shall last at least eight years*”. This would have caused problems because there is no specification if this time runs from the point of first exploitation, grant of protection or application.

[127] The invention of the automobile required the invention of the internal combustion engine first, for example.

[128] 17 U.S.C. § 902 (b)(2).

[129] Washington Treaty Article 3(2)(b).

[130] Toumi, p. 11.

That problem was corrected in the TRIPS Agreement. Article 38 specifies 3 different scenarios, all with different rules or times for the expiration of IP protection. There is a rule for countries that do not require registration, one for countries that do, and a third rule allowing prevention of abusive IP strategies, by way of denying any topography protection 15 years after its creation. The time from which the period of protection runs is specified as either first commercial exploitation anywhere in the world or the first time of applying for registration.

Normally the period of protection lasts from the first of either commercial exploitation or registration, but the text of the treaties does not require any of these options specifically. The implementing country chooses which is implemented.[131] The text can be found below for comparison.

[131] See section 5.

Countries requiring registration	Countries not requiring registration	Unused topographies
In Members requiring registration as a condition of protection, the term of protection of layout-designs shall not end before the expiration of a period of 10 years counted from the date of filing an application for registration or from the first commercial exploitation wherever in the world it occurs.[132]	*In Members not requiring registration as a condition for protection, layout-designs shall be protected for a term of no less than 10 years from the date of the first commercial exploitation wherever in the world it occurs.*[133]	*Notwithstanding paragraphs 1 and 2, a Member may provide that protection shall lapse 15 years after the creation of the layout-design.*[134]

[132] Article 38(1) TRIPS Agreement.

[133] Article 38(2) TRIPS Agreement.

[134] Article 38(3) TRIPS Agreement.

4.6 Registration

There is considerable leeway for countries in the matter of registration of semiconductor rights. They are allowed by Article 35 of the TRIPS Agreement and Article 7 of the Washington Treaty to choose whether to implement a registration requirement domestically. Article 4 of Directive 87/53/EEC also allows the E.U. member states to choose whether they want to implement a system of registration for the semiconductor rights as well. Consequently, as things stand, it is up the individual countries to decide whether they want to implement a regime of requiring registration.

The system where member states do not require registration shares characteristics with copyright law, and thus straddles the limit between industrial IP and copyright. Copyright law does not require registration, but instead gives protection the instant the work has been created.[135] While the SCPA and its equivalents, unlike copyright law, do not offer protection from the moment of creation, they still mirror copyright law in the way that protection is given as soon as the purpose of the IP has been fulfilled. In the case of copyright this is the protection of artistic expression, which happens whenever the artist produce their work.[136] However, semiconductor rights have a commercial purpose, as mentioned in section 3 of this paper, and accordingly the first commercial exploitation is where protection should begin under registration-free regimes according to Article 38(2) of the TRIPS Agreement.[137] However, there are countries that instead protect from the moment of creation, thereby exceeding the minimum requirement under the TRIPS Agreement. This can potentially cause a possibility for the period of protection to run longer than 10 years.[138]

Patent law, along with other industrial IP, requires registration as a precondition for protection.[139] Many countries implemented their own equivalent of the SCPA in a way that requires prospective holders of semiconductor rights to register their topographies. This reflects a view that semiconductor rights are in fact still industrial IP, that they are more similar to patents than copyrights, and that consequently registration should be required if they seek IP protection. This approach reflects how the underlying interest is more likely to be financial to a greater degree when applying for patents or topography rights than when initiating legal action over copyright claims. Neither patents nor topography rights place as much emphasis on the moral rights as copyrights.[140] Regimes requiring

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[135] See Berne Convention Articles 3-7[bis.]

[136] See Berne Convention Preamble: "*...animated by the desire to protect, in as effective and uniform a manner as possible, the rights of authors in their literary and artistic works.*".

[137] See Article 38(2) TRIPS Agreement.

[138] See section 5 for Israel and Sweden, the examples in this sample.

[139] See Article 29 TRIPS Agreement.

[140] See Article 6bis Berne Convention.

registration usually demand that it is done within a certain time after the first commercial exploitation of the topography, most commonly two years.[141]

Requiring a registration regime has been criticised on the basis of being an obsolete and cumbersome method of anti-piracy protection. The argument is that registering in every country one by one is too taxing on the potential registrants, and due to chip piracy having been made impossible by technical advances it is foregone due to lack of sufficient reason to do it.[142]

4.7 Exceptions to protection

4.7.1 Legal basis

There are exceptions for a number of situations to the exclusive rights added in both the TRIPS Agreement and the Washington Treaty. They can be found in Article 6 of the Washington Treaty and Articles 37 and Article 31 of the TRIPS Agreement.

4.7.2 Patent rules applying *mutatis mutandis* to semiconductors

Countries are allowed to have unique national exceptions to patent protection under Article 30-31 of the TRIPS Agreement. There is a general principle of proportionality formulated in Article 30. This is followed by Article 31 containing specific constraints. Article 37(2) stipulates that some of these rules shall also apply *mutatis mutandis* to semiconductor rights. Examples here include the requirement that exceptions are only as wide as needed for the intended purpose, that the right holders be compensated proportionately, etc. These are not specific exceptions, but instead conditions that exceptions must hold to.

4.7.3 Innocent infringement

There is an exception allowed for users of pirated chips who were not aware that the chips they were using were made without the consent of the owner of the exclusive right to make them. This exception can be found in Article 37(1) of the TRIPS Agreement. This exception frees the innocent infringer from paying royalties that would otherwise be due, but also obliges them to

[141] See section 5 for examples.
[142] Kukkonen, p. 132-137.

cease using the pirated chips as soon as they find out that the chips are pirated. In some jurisdictions this is called a good-faith exception.[143]

4.7.4 Private research and teaching by third party

There is a general exception in Article 6(2)(a) of the Washington Treaty for a similar purpose to Article 10 of the Berne Convention. This allows for the private reproduction of the topography provided it is for private purposes or for the sole purpose of evaluation, analysis, research or teaching. Under this exception no commercial gain may be had from the otherwise infringing material.

4.7.5 Reverse engineering

One of the more controversial exceptions to protection for semiconductor rights is the exception for reverse engineering found in Article 6(2)(b) of the Washington Treaty.[144] The U.S. SCPA and Dir. 87/53/EEC contain the corresponding reverse engineering exceptions in 17 U.S.C. § 906(a)(2) and Article 5(4) respectively.

This rule can be invoked to defend against claims of chip piracy if there has been an addition that could be considered original to an otherwise copied topography that is being commercially exploited. The problem that renders this exception so controversial is thus made obvious. Ascertaining the limit for the permitted grade of likeness of the original to the copied topography is difficult in practice. The upper permitted limit for this similarity requires that an analogy be drawn to copyright law since, as mentioned in section 4.3, the standard of originality that applies is nearly identical. While the question there is how similar a work can be to prior art before it plagiarises it in copyright law, the question under semiconductor topography legislation is how much can be gleaned from prior topographies before they have been infringed upon.

In the case of the U.S. the reverse engineering exception allows the creation of mask works based on what is learned when reverse engineering a protected set of mask works. The question of upper permitted limits to

[143] See for example Article 24(1) of the Japanese Act Concerning the Circuit Layout of a Semiconductor Integrated Circuit(Law linked in section 5 for consistency, where laws are specifically discussed).

[144] Radomsky, p. 1060-1063. In particular the footnotes provide a wealth of commentary with varying levels of approval of this exception.

similarity was raised in the case of *Brooktree v. AMD*.[145] The case involved Brooktree, the plaintiff, claiming that AMD, the defendant, had reverse engineered their chips to such a degree that it constituted infringement. There was an ambiguity in the law concerning the upper limits of permitted similarity that led to this case setting precedent. The court held that there was no specific degree or percentage of similarity up to which copying was allowed, but instead followed an analogy to copyright law and held that the "material part" of the chip had been copied, which would mean that the chip was essentially the same. Thus the rule established in U.S. case law is that the "material part" cannot be copied under reverse engineering exceptions.[146,147]

In countries where it is the topography itself that is protected and not the mask works the situation remains unclear. There is no case law to establish any consensus in Europe on the matter, so the doctrine is left to speculate.[148] Since the mask works that are protected in the U.S. are a mirror image of the topography, which is the protected subject matter elsewhere, the same logic likely applies. It would be surprising if courts held otherwise since that would undermine uniform application of the treaties.

As a last note, it is worth mentioning that this exception is found in the implemented parts of Washington Treaty, which means that this exception has to be allowed by all signatory countries of the TRIPS Agreement. However, there are questions as to how broad this exception is in certain countries.[149] There are questions as to whether the laws of Japan or South Korea allow for products that were the result of reverse engineering to be sold at all, with certain commentators believing that this is not the case.[150,151]

4.8 Exhaustion of rights

Exhaustion of the rights of the holder of the semiconductor rights takes place when the IC chips are sold into the market. The rules vary very little over the jurisdictions in this regard, as can be seen when comparing the Washington Treaty, the U.S. SCPA and Directive 87/53/EEC below.

[145] *Brooktree Corporation v. Advanced Micro Devices, Inc.* 977 F.2d 1555, 1992 Copr.L.Dec. P 26,997, 24 U.S.P.Q.2d 1401.

[146] Radomsky, p. 1061-1062.

[147] The ruling stated in point 32 that: "*If the copied portion is qualitatively important, the finder of fact may properly find substantial similarity under copyright law and under the Semiconductor Chip Protection Act*" and mentioned that "*copying of a material portion*" was prohibited in point 35.

[148] Hoeren, p. 5-6.

[149] Radomsky, p. 1070.

[150] Kukkonen, p. 120, 128.

[151] Radomsky, p. 1066-1067, 1070.

Washington Treaty	U.S. SCPA	Dir. 87/53/EEC
"…any Contracting Party may consider lawful the performance, without the authorization of the holder of the right, of any of the acts referred to in that paragraph where the act is performed in respect of a protected layout-design (topography), or in respect of an integrated circuit in which such a layout-design (topography) is incorporated, that has been put on the market by, or with the consent of, the holder of the right."[152]	"*…the owner of a particular semiconductor chip product made by the owner of the mask work, or by any person authorized by the owner of the mask work, may import, distribute, or otherwise dispose of or use, but not reproduce, that particular semiconductor chip product without the authority of the owner of the mask work.*"[153]	"*The exclusive rights to authorize or prohibit the acts specified in paragraph 1 (b) shall not apply to any such act committed after the topography or the semiconductor product has been put on the market in a Member State by the person entitled to authorize its marketing or with his consent.*"[154]

[152] Washington Treaty Article 6(5).

[153] 17 U.S.C. § 906(b).

[154] Directive 87/53/EEC Article 5(5).

4.9 Compulsory licensing

There are countries in which national courts can order the licencing of semiconductor topography rights, sometimes even *ex officio*. The Washington Treaty specifies the rules for such licensing in Article 6(3), but the TRIPS Agreement makes an exception in its implementation, leaving the topic open for individual countries to decide. The E.U. allows choice in this regard as well, with the caveat that purely the passing of time shall not be a reason for the granting of non-voluntary licenses.[155]

The question of compulsory licensing is highly contentious, and is one of the reasons the U.S. and Japan were sceptical toward the Washington Treaty. With them being such a key players in the negotiations, it is not unreasonable to surmise that this may have been the reason that the Washington Treaty failed.[156]

4.10 Employers as holders of rights

In many cases IP rights are held not by the individual responsible for developing them, but the company, organisation, or government entity in whose employ the inventor was when the invention was made.[157]

Semiconductor right are no different, and semiconductors topographies created as a part of tasks as an employee or while otherwise in the service of another natural or legal person can be the property of the employer.[158] It is worthwhile to note that there are differences in the national regimes on this topic as well. Some countries explicitly make rules for semiconductor topographies, while others simply use the same rules as for patents. Others still only apply employers rights to the creations of the employees in a limited manner. Some reserve the right to be mentioned as creator even if the economic rights are given away through employment.[159]

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[155] Article 6 Directive 87/53/EEC .

[156] Radomsky, p. 1071-1076.

[157] See example in the Swedish Act 1949:345 on the rights to the inventions of employees(Swe: Lag (1949:345) om rätten till arbetstagares uppfinningar).

[158] See 17 U.S.C. § 901(a)(6), Dir. 87/53/EEC Article 3(2)(a).

[159] Hoeren, p. 9-10 contains examples for all of these. See section 5 for further examples.

4.11 Sanctions

There is no coordination on sanctions regimes in regards to semiconductor rights. Some countries apply the sanctions regime of their other IP laws, while some countries have their own sanctions regime for semiconductor rights.[160]

It is interesting to note that Taiwan has recently enacted a harsh regime in this regard, as can be seen by the 12 year prison sentence tech theft can carry.[161] In contrast, neither France nor the U.S. has a criminal sanctions regime in place.[162] In these countries there is only civil liability associated with infringing on semiconductor topography rights. This lack of coordination risks creating so-called "chip piracy havens" should use of semiconductor topography IP rights increase.[163]

4.12 Principle of reciprocity

One of the major features of the SCPA was the so-called "principle of reciprocity" found in 17 U.S.C. § 902(a)(2). Its purpose was to allow the U.S. to pressure other countries into adopting similar IP legislation, an effort that was successful, as can be seen in the fact that every country that is a member of the WTO now has such *sui generis* IP law.[164] If the semiconductor topographies could have been protected under copyrights or patents this principle would have been made impossible to implement due to the Berne and Paris conventions already standardizing the jurisdictional application of the IP rights on a national treatment basis.[165] However, thanks to semiconductor rights being a new *sui generis* type of IP neither convention applies.[166]

The principle works so that any country can issue declarations that extends semiconductor topography IP protection to the citizens of another country as if they were citizens in the country making the declaration. This is done when the country issuing the declaration finds that the country subject to it has adopted substantially similar legislation. The principle precludes the principle of national treatment, which is a cornerstone of other industrial IP law, and instead uses the principle of material reciprocity.[167] Examples of

[160] Hoeren, p. 11.

[161] Nakamura, Yu: Taiwan sets 12-year prison term for stealing tech secrets, NIKKEI Asia News, 20-05-2022. The National Security Act does not specifically criminalise infringing semiconductor rights, but there is a significant overlap between that and the actions criminalised under the Act. See more in section 5.

[162] Hoeren, p. 11.

[163] Hoeren, p. 11.

[164] Hoeren, p. 1-2.

[165] Article 5(3) Berne Convention and Article 2 Paris Convention.

[166] Kukkonen, p. 110.

[167] Hoeren, p. 5-6.

these declarations are E.U. Council Decisions 96/644/EC(Isle of Man), 94/824/EC(WTO members), 94/700/EC(Canada), and 93/16/EEC(U.S.).[168]

However, since the TRIPS agreement is obligatory to members of the WTO, which by now encompasses the vast majority of nations worldwide, this principle has arguably become redundant. There is no need for nations to unilaterally strong-arm other nations into adopting this type of legislation after they join the WTO. They will already have adopted such rules as part of joining the WTO. An example of a state that chose to retain the principle of national treatment is Japan. What is interesting is that they chose to do this before the TRIPS Agreement came into force or the Washington Treaty would have came into force.[169] It is also likely that implementation of the TRIPS Agreement by one country essentially forces another to accept their new topography laws.

[168] All retrieved 2022-10-16.
[169] Radomsky, p. 1066.

5 Legislation in significant countries

5.1 Purpose of examining countries

In order to further examine the situation it is prudent to explore the choices countries have made regarding the implementation of semiconductor protection legislation. The specifics of the definition of the protected subject matter, if there is any compulsory licensing regime in place, registration requirements, sanctions regimes, employer rights, exceptions to protection, and whether the principle of reciprocity has been employed will be explored. These are the areas where differences between countries are most prevalent and therefore these areas warrant particular attention.[170]

5.2 International Treaties

Articles 35-38 of the TRIPS agreement are the main international standards to which nations adhere on the topic of semiconductor topography rights. These articles also apply Article 31 *mutatis mutandis* concerning the limits of what is allowed under the TRIPS Agreement when introducing an exception to the exclusive rights granted. Article 31 regulates patent law normally. The main rule in the TRIPS Agreement is that most of the material parts of the Washington Treaty of 1989 applies through the TRIPS Agreement. Specifically this means Articles 2-7 (excluding Article 6(3)), Article 12, and Article 16(3) are in effect even it the countries did not ratify the Washington Treaty. Articles 36-38 set out the rules that were added or changed in the TRIPS Agreement compared to the Washington Treaty.

5.3 Choice of countries to highlight

5.3.1 Reasons for choice

When exploring the different countries' legislation on IP protection for semiconductor topographies it is important to highlight countries with special importance to the topic. This importance is gained from having a leading role in the global semiconductor industry, an otherwise special relationship to the industry, a large centrally placed economy in general, interesting legislative solutions, or some combination thereof.

Consequently, the countries explored closer will be the United States, Japan, South Korea, E.U. with some of its member states highlighted, China,

[170] Simplified table available in Annex 1.

Taiwan and Israel. Other countries that might be interesting, but will not be explored due to underdeveloped semiconductor industries, lacking rule of law, or dominant industries in neighbouring countries are Canada, India, Russia, Mexico, Italy, Spain, Kenya, Australia, Vietnam, Turkey, Poland, Brazil and Indonesia. Readers are encouraged to conduct studies on these countries in detail themselves.

5.3.2 “The Old Guard”

The U.S. and Japan were the two first countries to introduce semiconductor IP legislation, in 1984 and 1985 respectively. As such they have a natural place in any comparative sample of countries for the purpose of comparing such legislation. In addition both countries have comparatively large economies, both with a significant semiconductor industry.

The U.S. is the birthplace of the semiconductor, the associated industry, and houses some of the largest actors in the industry, such as Intel, Nvidia and AMD. Japan was the first country to cave in to U.S. pressure to introduce the new *sui generis* IP type of semiconductor topography.[171] Japan also houses many actors of the semiconductor industry. Together they were a major obstacle for the Washington Treaty, thereby precipitating the current WTO-led harmonisation regime.[172]

5.3.3 East Asian powerhouses

Since initially starting out in the U.S. the semiconductor industry has established a significant presence in the East Asian countries of Japan, South Korea, Taiwan, and China. Today they collectively house the largest concentration of semiconductor industry on Earth.

A distinct feature of their economies is the close cooperation of the state and certain major industrial and business conglomerates, such as the South Korean *chaebol*, the Japanese *keiretsu*, or Chinese state-owned corporations. Many of these such, as Samsung, SK Hynix, Tsinghua Group, UNISOC, HiSilicon, TSMC, Foxconn and Toshiba are active in the semiconductor industry.

5.3.4 The E.U.

The E.U. has many member states with significant economic influence and a role in the international economy. The E.U is also one of the most economically integrated areas on Earth and houses a consumer market on par with the U.S. Therefore a sample of its member states, along with the E.U. directive, will be presented. This sample will include Germany,

[171] Radomsky, p. 1066.
[172] Radomsky, p. 1074.

France, the U.K., the Netherlands and Sweden. These countries either house significant economies in general, have a strong hi-tech industry, or distinct legal variations on semiconductor IP law that are interesting. European companies that are active in the industry include ASML, Bosch, Siemens, ABB and Ericsson.

5.3.5 Small tech-heavy economies

There are a few geographically small economies that have a uniquely strong relationship to their tech industries, of which the semiconductor industry is part. This makes them interesting for the purposes of this paper, due to the influence such legislation has on them. This sample includes Israel and Taiwan. Both also have a violent history with their neighbours, meaning that technological advantages are presumably sought after for strategic and diplomatic purposes.

5.3.6 Non-registration jurisdictions

There are countries that have chosen to not implement registration requirements for topography rights. Three of those are included in the sample: The U.K., Sweden, and Israel. This allows for comparing registration and non-registration regimes.

5.4 U.S.: Semiconductor Chip Protection Act 1984[173]

The most distinct feature of the U.S. law is its definition of the protected subject matter, as mentioned under section 4.1. Of the sample only the U.S. uses the term "mask works", along with its attendant restrictions, to define the protected subject matter.[174] All other countries included in this study use some version of the more technology-neutral terms, thereby granting the U.S. the most restrictive definition of the protected subject matter in the sample. U.S. rules requires the materials used to manufacture the IC chips to be metallic, insulating, or semiconductive. It does not protect intermediate products or individual layers seeing as how the template for the finished product is the protected subject matter. This also means that methods of production that do not use mask works are not protected either.[175] The U.S. definition imposes a burden of proof significantly more difficult to fulfill than other countries studied. This is due to the fact that the topographies

[173] Semiconductor Chip Protection Act, 17 U.S.C. § 901-914: Available at Cornell Law School Legal Information Institute(Retrieved 2022-12-30).
[174] 17 U.S.C. § 901(a)(2).
[175] 17 U.S.C. § 901(a)(2).

themselves are not protected under U.S. law, and thus the infringing mask works need to be extrapolated from the allegedly infringing circuitry in order to prove infringement, a tedious and resource-demanding prospect.[176] The finished product is required to have an electronic function.[177]

The U.S. requires mask works to be registered, and will end protection in the U.S. two years after first commercial exploitation if registration has not been applied for by then. Protection begins at registration or first commercial exploitation and ends on December 31st ten years later.[178]

The U.S. employs the principle of reciprocity, and therefore requires foreign nationals' home countries to also protect semiconductor topography rights before recognising their rights in the U.S.[179]

U.S. law gives the employer the IP rights instead of the creator of the mask work if the creator created it while in the employ of the employer.[180]

The U.S does not employ criminal sanctions for the infringement of semiconductor rights. The U.S. allows for full recovery of damages in court or the award of statutory damages of maximum 250 000 USD.[181]

The U.S. uses a reverse engineering exception and an exception for non-commercial purposes. The U.S requires the reverse engineered mask works to be original, the meaning of which was clarified to mean that they must not have the same "material part" in case law.[182]

The U.S. does not maintain a regime of compulsory licensing.[183] This is because Congress favoured an approach based on the principles of the free market.[184]

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[176] Radomsky, p. 1067.
[177] 17 U.S.C. § 901(a)(1)(B).
[178] 17 U.S.C. § 904, 908.
[179] 17 U.S.C. § 902(a)(2).
[180] 17 U.S.C. § 901(a)(6).
[181] 17 U.S.C. § 911(b)-(c).
[182] Brooktree Corp. v. Advanced Micro Devices, Inc., 757 F. Supp. 1088 (S.D. Cal. 1990).
[183] Radomsky, p. 1070.
[184] Radomsky, p.1070-1073.

5.5 Japan: Act Concerning the Circuit Layout of a Semiconductor Integrated Circuit[185]

The Japanese introduced legislation in 1985 to protect semiconductor topographies that protects the "circuit layout" itself, thereby allowing for the protection of topographies created without mask works and remaining neutral to the method of production. This also eased issues with the burden of proof.[186] Japanese semiconductor IP protection law includes requirements on materials being semiconductors through the definition of the finished product. It does not specify layers, thus allowing for protection of single layers. The protected subject matter must be housed inside a "semiconductor integrated circuit", which means that products in the intermediate stages of production are not protected, since the finished product is defined to have inseparably formed on semiconductor materials. The finished semiconductor product is required to perform an electronic circuitry function.[187]

The Japanese employ a system for the registration of topographies, and do not take into account prior exploitation anywhere in the world. In Japan registration is therefore required for protection to be valid. Registration must be done at the latest two years after first commercial exploitation.[188] It is worth noting that the Japanese protect from the moment of registration, not first exploitation, thereby allowing for protection to be had at a later point in the market life if the chip. Protection lasts 10 years.[189]

The Japanese chose not to employ the reciprocity principle. Instead they employ the principle of national treatment. The law simply speaks about "creators" when referring to the holders of the rights.[190]

Japanese law also gives employers the IP rights instead of the creator of the topography if the creator created it while in the employ of the employer.[191]

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185 Act Concerning the Circuit Layout of a Semiconductor Integrated Circuit: Available at WIPO Lex(Retrieved 2022-12-30).

186 Radomsky, p. 1067.

187 Article 2, Act Concerning the Circuit Layout of a Semiconductor Integrated Circuit(hereafter SLA).

188 Article 6, 10 SLA.

189 Article 10 SLA.

190 Article 3 SLA.

191 Article 5 SLA.

Japan uses a regime of criminal sanctions parallel to the civil remedies available. These include both fines and up to three years in prison.[192] The civil remedy is compensation in accordance with what would have been paid in royalties had a licensing agreement been in force in addition to damages.[193] There is also injunctive relief available.[194]

Japan allows for reverse engineering without a license for analysing and evaluating the protected subject matter.[195] What is interesting here is that it seems this is only an exception for non-commercial purposes, since purpose is not indicated in the statute, like other rules in the law. Therefore a strict reading would suggest that there is no reverse engineering exception in Japan like the one in the U.S.[196,197]

Japan does not have a regime of compulsory licensing.[198]

5.6 South Korea: Act on the Layout-Designs of Semiconductor Integrated Circuits[199]

The South Korean law on the subject, Act on the Layout-Designs of Semiconductor Integrated Circuits, was enacted in 1992 and significantly amended in 2008. The protected subject matter is the "layout-design", with even broader definitions of the protected subject than the Japanese act. The definition includes no mention of layers, instead explicitly mentioning two or three dimensions, thereby protecting single layers. Material requirements are only included as a part of the required placement of the layouts-designs in semiconductor integrated circuits. The process is broadly described as "integrating circuit elements", and the statute explicitly mentions semi-finished products, thereby protecting intermediate stages of production and not limiting itself to any specific mode of production. Consequently it can be concluded that the South Korean definition of the protected subject matter is comparatively wide. Furthermore, the finished product is required to have an electronic function. [200]

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[192] Article 51-56 SLA.

[193] Article 25, 27 SLA It might help to copy and paste Article 27 onto a separate document and restructure it for ease of reading the English translation.

[194] Article 22 SLA.

[195] Article 12(2) SLA.

[196] Radomsky, p. 1066-1067, 1070.

[197] Kukkonen, p. 120, 128.

[198] Radomsky, p.1070.

[199] Act on the Layout-Designs of Semiconductor Integrated Circuits: Available at WIPO Lex(Retrieved 2022-12-30).

[200] Article 2Act on the Layout-Designs of Semiconductor Integrated Circuits(Hereafter ALSC).

South Korean law requires that a topography be registered. This is to be done within two years of the first commercial exploitation.[201] The exclusive rights under the law last 10 years from the registration or the first exploitation, whichever was first.[202]

The Koreans employ the reciprocity principle, with the detail that the default position is that a foreigner will receive protection. Therefore th government must issue a decision *not* to recognise the topographies if any particular country's citizens.[203]

South Korean law gives the employer the IP rights instead of the creator of the topography if the creator created it while in the employ of the employer.[204]

South Korean Law allows for injunctive relief, damages and, in the case of bad faith infringement, retroactive compensation for infringement of topography rights.[205] In addition infringements are criminally sanctioned and carry a sentence of a maximum of 3 years in prison and a 50 000 000 KRW fine.[206] Other crimes related to breach of confidentiality, fraudulent application for protection, or falsely indicating topographies can also be criminally sanctioned.[207]

The exceptions to the exclusive rights include a non-commercial and private use exception for non-profit purposes in the first subparagraph of Article 9 of the law. The English translation leaves some ambiguity in regards to reverse engineering for commercial purposes, however. The second subparagraph of the statute does not explicitly contain itself to non-commercial purposes, but at the same time do not mention commercial purposes either. It does however refer back to the first subparagraph.[208] From this, backed by pre-2008 amendment literature, it would seem that the reverse engineering of topographies for commercial purposes is not allowed under South Korean law.[209]

South Korean law has a regime of compulsory licensing that allows for competition, national emergency or similar, and anti-abuse licensing on a non-voluntary basis.[210] The reason for this being included in the Korean law was that South Korea needed a way to protect themselves from the Japanese

[201] Article 19(1) ALSC.
[202] Article 7 ALSC.
[203] Article 3 ALSC.
[204] Article 5 ALSC.
[205] Article 35-38 ALSC.
[206] Article 45 ALSC.
[207] Article 46-48 ALSC.
[208] Article 9 ALSC.
[209] Kukkonen, p. 128.
[210] Article 13(3)-(4) ALSC.

and U.S. companies stifling their market by protecting all the most profitable topographies and then preventing them from being used by South Korean companies. This situation arose due to that the U.S. and Japan initially refused to adhere to the rules proposed in the Washington Treaty.[211]

5.7 EU: Directive 87/54/EEC[212]

5.7.1 The directive

The European Directive is almost a carbon copy of the U.S. SCPA.[213] This can clearly be seen in the wording of the definition of the subject matter in Article 1(b), which is structured and worded in a strikingly similar way to 17 U.S.C. § 901(a)(2).

One of the few significant differences between the U.S. and the E.U. rules is that the definition of the protected subject matter is wider in Europe to accommodate a more technology-neutral definition, a similarity it shares with its other non-U.S. equivalents. The term used is "topography". It requires the presence of a three dimensional topography, meaning that individual layers are not protected. The materials are required to contain at least one layer of semiconductive material. The choice of method is free and intermediate stages of production are explicitly protected through the phrasings "*however fixed or encoded*" and "*final or an intermediate form of any product*" in the definitions of the topography and the products in which the topography resides.[214] The products of the member states must fulfill an electronic function.[215]

The question of requiring registration is left to the member states to decide. Member states must require registration within the first two years after the first commercial exploitation of the topography if they choose to require registration.[216] For member states not requiring registration of topographies the period of protection is to end at the end of the tenth calendar year following first commercial exploitation. For member states requiring registration the same applies, unless the ten year anniversary of the registration is earlier, in which case that is used as the limit instead.[217]

Europe employs the reciprocity principle instead of the national treatment principle. The directive contains procedural rules regarding the division of

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[211] Kukkonen, p. 126-127.

[212] Directive 87/54/EEC: Available at EURLex(Retrieved 2022-12-30).

[213] Kukkonen, p. 121.

[214] Article 1a-1b Dir. 87/54/EEC.

[215] Article 1(1)(a)(iii) Dir. 87/54/EEC.

[216] Article 4 Dir. 87/54/EEC.

[217] Article 7(3) Dir. 87/54/EEC.

labour between the member states and the E.U. Commission.[218] The E.U. has issued reciprocity decisions in regards to all WTO members.[219]

The E.U. allows the member states wide autonomy in giving employees or employers the rights to the topographies.[220] The question will be addressed as part of the sections on the individual member states below.

The E.U. does not harmonise the sanctions regimes of its member states in regards to semiconductor topography rights.[221,222]

The E.U. directive allows for a non-commercial exception for protection and a reverse engineering exception. The non-commercial exception is typical and allows for analysing, evaluating or teaching the concepts, processes, systems or techniques embodied in the topography. The reverse engineering exception require that the new topography satisfy the same standard of originality that a completely new topography would.[223]

The question of compulsory licensing rests with the member states.[224]

5.7.2 Implementation in Germany

The German equivalent of the SCPA, the *Halbleiterschutzgesetz*[225], is an implementation of the E.U. directive. It was enacted in 1987 and last amended in 2017.

The definition of the protected subject matter includes a requirement for three dimensions, meaning that individual layers are not protected. The law also speaks about microelectronic semiconductor parts, thereby requiring semiconductive materials to be part of the topography. Methods of production are not mentioned and are therefore not a requirement. The law protects "structures", which could mean the intermediate stages of production, and in light of the wording of the directive must do so.[226]

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[218] Article 3(6)-(7) Dir. 87/54/EEC.

[219] EURLex: 94/824/EC (WTO members).

[220] Article 3(1)-(2) Dir. 87/54/EEC.

[221] Hoeren, p. 11.

[222] The E.U. can only harmonise material criminal law under special conditions set out in Article 83(1) TFEU. Infringement of IP is not listed there, which means the council needs unanimous consent to approve such legal acts.

[223] Article 5(3)-(4) Dir. 87/54/EEC.

[224] See Dir. 87/54/EEC preamble about "non-voluntary licences". Article 207(1) and 207(4) TFEU grants the E.U. legislative competence in matter relating to "*commercial aspects of intellectual property*" At the time of the adoption of the directive Article 100 of the Treaty of Rome was invoked. Se Hoeren , p. 2.

[225] Halbleiterschutsgesetz: Available at Bundesministerium der Justiz(Retrieved 2022-12-30)(Machine translation).

[226] § 1(1) Halbleitershutsgesetz (Hereafter HalblSchG).

Germany has a regime of registration. To obtain protection in Germany it is mandatory to have registered the topography with the German patent and Trademark office. Protection lasts 10 years from the start of protection, which is either first exploitation or registration.[227] The law does not specify if it is possible to assert protection retroactively if infringement took place after first exploitation but before registration.

German law employs the principle of reciprocity.[228]

German law grants the rights to the topography to the employer if it was created by an employee unless employment contracts stipulate otherwise.[229]

Germany employs a system of both criminal and civil sanctions against infringements. There is injunctive relief available, the German patent act is used *mutatis mutandis* to determine damages, and up to five years in prison may be handed down in sentences related to infringements of topography rights. If it is in the public interest the prosecutors office may even initiate prosecution *ex officio.*[230]

Germany has exceptions to the exclusive rights for non-commercial purposes and a reverse engineering exception.[231]

Germany employs a regime of compulsory licensing, which is found under competition and patent law.[232]

5.7.3 Implementation in the U.K.

The U.K. includes the protection of semiconductors under the Copyright, Designs and Patents Act of 1988.[233] There the semiconductor regulations are grafted onto already existing law through Design Right (Semiconductor Topographies) Regulations 1989.[234,235] It should be noted that this is retained E.U. legislation, which means the legal particularities of the U.K. leaving the E.U. apply.[236]

[227] § 3-5 HalblSchG.
[228] § 2(6) HalblSchG.
[229] § 2(2) HalblSchG.
[230] § 9-10 HalblSchG.
[231] § 6(2) HalblSchG.
[232] Hoeren, p. 11.
[233] Copy, Design, and Patent Rights Act 1988: Available at National Archives(Retrieved 2022-12-30).
[234] Design Right (Semiconductor Topographies) Regulations 1989: Available at National Archives(Retrieved 2022-12-30).
[235] Hoeren, p. 7-8.
[236] There is a bill on its way through the House of Commons currently that might revoke this law along with other retained E.U. instruments wholesale.(Retrieved 2023-02-03).

The definition of the protected subject matter in the U.K. requires the topography to be a design in the meaning of the Copyright, Designs and Patents Act 1988,[237] with the following added requisites:

a) "*the pattern fixed, or intended to be fixed, in or upon-*

   i. *a layer of a semiconductor product, or*

   ii. *a layer of material in the course of and for the purpose of the manufacture of a semiconductor product, or*

b) *the arrangement of the patterns fixed, or intended to be fixed, in or upon the layers of a semiconductor product in relation to one another.*"[238]

There is a requirement for semiconductors to be present in the topography, single layers are protected, methods are not mentioned and therefore free to choose, and intermediate stages of production should be protected under E.U. law.[239] While this legal arrangement is unusual compared to other countries, it does not violate the TRIPS Agreement or Dir. 87/54/EEC.

The U.K. chose an approach much more similar to copyrights by not implementing a system for registration of the semiconductor rights. Instead protection begins when the topography is first commercially exploited, and ends at the end of the tenth year after that.[240]

The U.K. employs the reciprocity principle.[241]

The U.K. gives the rights to employers and commissioners in cases where the creator is in their employ.[242]

Since the U.K. considers topographies designs, another form of IP, for all purposes not listed in the Design Right (Semiconductor Topographies) Regulations. The same criminal sanctions apply for infringement, maximum 10 years in prison and fines.[243,244] Civil remedies include injunctions, seizure, destructions of infringing materials, and damages.[245]

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[237] Specifically § 213 of the Copyright, Designs and Patents Act(Hereafter CDPA).

[238] Regulation 2(1) Design Right (Semiconductor Topographies) Regulations 1989(Hereafter DRR).

[239] The intermediate stages might not be protected, which used to be in violation of the Directive. See Kukkonen, p. 123.

[240] Regulation 6 DRR omits mention of registration. See also Hoeren, p. 7-8.

[241] Regulation 4 DRR The states from whom the design rights are recognised are listed in the attached schedule.

[242] Regulation 5 DRR.

[243] Regulation 3 DRR.

The U.K. has typical exceptions for non-commercial purposes and reverse engineering.[246]

The U.K does not employ a regime of compulsory licencing.[247]

5.7.4 Implementation in the Netherlands

The Dutch law on semiconductors was passed in 1987 and is also an implementation of the E.U. directive.[248]

The definition of the protected subject matter is one that requires three dimensions, thereby not protecting individual layers. The material must a be semiconductor. Intermediate products are protected by mention of "*any stage of production*", and methods are not specified, thereby allowing all production methods.[249]

Dutch requires registration and will not protect the topography unless it has been registered. Topographies must be registered within two years of first commercial exploitation. Protection lasts 10 years from the earlier of the end of the year of registration or the end of the year of first exploitation. [250]

The principle of reciprocity is used by the Netherlands.[251]

The Netherlands grants the rights to the topography to the employer, provided that the task of the employment is to produce topographies, unless otherwise agreed.[252]

The Netherlands has a maximum of 6 months prison and fines as criminal sanctions related to the wilful infringement of semiconductor topography rights.[253] The civil remedies include transfers of profit, injunctions or damages.[254]

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[244] § 35ZA Registered Designs Act 1949(Available at the National Archives)(Retrieved 2023-01-03).

[245] § 229-231 CDPA.

[246] Regulation 8 DRR.

[247] Hoeren, p. 11.

[248] Regulations for the Protection of Original Topographical Designs for Semi-Conductor Products 1987: Available at WIPO Lex(Retrieved 2022-12-30).

[249] Article 1b, Act of October 28, 1987, Containing Regulations for the Protection of Original Topographical Designs for Semi-Conductor Products(Hereafter RPOTD).

[250] Article 5(2), 7-9, 13 RPOTD.

[251] Article 26b RPOTD.

[252] Article 3 RPOTD.

[253] Article 24 RPOTD.

[254] Article 17(1)-(2), 18 RPOTD.

The Netherlands has exceptions to protection for non-commercial purposes and reverse engineering.[255] However, their main protective rule includes all activities that in other countries are only protected when done for commercial purposes, which means these exceptions carve out an exception from a much broader rule than in most other countries.[256,257]

The Netherlands allows for granting of compulsory licenses for non-commercial or as a part of limiting anti-competitive practices.[258]

5.7.5 Implementation in France

The French law on semiconductors is found in the French Intellectual Property Code Book VI, Title II, Chapter II.[259] The material law stipulates that filing must be of "semiconductor products", thereby requiring the materials to be semiconductors. Layers are not mentioned, which leads to the conclusion that the rules of the directive apply. The same applies to production methods. However, intermediate stages of productions are explicitly protected.[260]

Registration is required in France and must take place at the latest 2 years after the first commercial exploitation of the topography. Protection begins when samples are deposited by the person seeking protection. If the first commercial exploitation takes place earlier that is used as the start date of protection instead. It ends at the end of the tenth calendar year that follows.[261]

France employs the principle of reciprocity.[262]

In France the creator owns the exclusive rights to the topography.[263] It is worth noting that, for example, patents have different rules, where the employer receives the rights if the employee is specifically employed to develop new patentable subject materials.[264]

[255] Article 15 RPOTD.
[256] Article 5 RPOTD.
[257] Hoeren, p. 5 footnote 20.
[258] Article 57a Dutch Patent Act(Available at WIPO Lex)(Retrieved 2023-01-03)(Machine translation).
[259] France CPI: Available at Japan Patent Office(Retrieved 2022-30)(Translated at Japan Patent Office).
[260] Article L622-1 Code de la Propriété Intellectuelle(hereafter CPI).
[261] Article L622-1, L622-6 CPI.
[262] Article L622-2 CPI.
[263] Article L622-3 CPI.
[264] Article L611-7 CPI.

France does not employ a criminal sanctions regime for infringements of semiconductor rights. Civil remedies are used exclusively.[265]

France does not allow reproduction, i.e. primary infringement, for any other purpose than the exceptions for evaluation, analysis or teaching purposes by other parties than the owner. This knowledge is allowed to be used for reverse engineering. Secondary infringement is not allowed for commercial purposes.[266]

Compulsory licenses may be imposed for public, non-commercial purposes or to remedy a practice declared anti-competitive.[267]

5.7.6 Implementation in Sweden

The Swedish law on semiconductor protection[268] was introduced as a part of the harmonisation of rules that preceded Swedish entry into the E.E.C.[269]

The Swedish law was updated from its previous iteration in 1994.[270] The law requires that there are multiple layers in a product made of semiconductors. It makes no mention of methods of production or intermediate products, which therefore can be assumed to be under the same rules as the directive.

Sweden does not require registration of topographies and recognises the rights to them from the moment of their creation. Protection lasts until 10 years after first exploitation, which means Swedish protection could potentially last more than 10 years. This is only limited by the 15 year period after creation that protection stops regardless of when it was exploited.[271]

Sweden uses the principle of reciprocity.[272]

In Sweden employers are given the rights to the topography if an employee creates a topography.[273]

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[265] Article L622-5 CPI only mentions civil liability as a consequence, thereby excluding criminal liability. Other *sui generis* types of IP have specific penal statutes that are not found in relation to semiconductor rights.

[266] Article L622-5 CPI.

[267] Article L613-19-1 CPI.

[268] Law(1992:1685) on protection of circuit patterns for semiconductor products: Available at the website of the Swedish Parliament(Retrieved 2022-12-30)(Swedish language).

[269] Proposition 1992/93:48 *om ändringar i de immaterialrättsliga lagarna med anledning av EES-avtalet m.m.*, p. 1.

[270] Prop. 1992/93:48, p. 44.

[271] 4 § Lag (1992:1685) om skydd för kretsmönster för halvledarprodukter(Hereafter SFS 1992:1685).

[272] 15 § SFS 1992:1685.

Sweden employs both criminal and civil sanctions for infringements of topography rights. Criminal sanctions can in aggravated cases carry a sentence of six years in prison and fines. Civil sanctions include damages and injunctive relief.[274]

Sweden has a reverse engineering exception that is less extensive than usual. They do not allow for commercial exploitation of analysed topographies, only teaching, analysis, and private use. They do not allow the creation of actual chips with the analysed topographies, only drawings.[275] Sweden also has provided an exception for if the topography is subject to FoI-related matters, which are safeguarded in the Swedish constitution.[276]

Sweden does not employ compulsory licensing.[277]

5.8 China: Regulations on the Protection of Layout-Designs in Integrated Circuits[278]

Chinese law requires that the topographies have at least two layers and have a three dimensional layout. This means that individual layers are not protected. Additionally there must be at least one "active element" in the topography. This means that materials do not need to be semiconductors, but they must be able to fulfill the function of one. The intermediate stages are protected through mention of "*…a three-dimensional disposition prepared for the manufacture…*". Methods are not required.[279] The finished product must fulfill an electronic function.[280]

China requires topographies to be registered and will not protect them without registration. This must be done within two years of the first commercial exploitation. Protection starts at the earlier of first exploitation or registration.[281]

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273 3 § SFS 1992:1685.

274 9, 11-12 §§ SFS 1992:1685.

275 SOU 1985:51 *Upphovsrätt och datorteknik: Delbetänkande 3*, p. 18, 142.

276 5, 7 § SFS 1992:1685.

277 8 § SFS 1992:1685.

278 Regulations on the Protection of Layout-Designs in Integrated Circuits: Available at Ministry of Science and Technology(Retrieved 2022-12-30).

279 Article 2(2) Regulations on the Protection of Layout-Designs of Integrated Circuits(Hereafter RPLC).

280 Article 2(1) RPLC.

281 Article 8, 17 RPLC.

China employs the principle of reciprocity.[282]

China gives the right over the topography to the employer if the creator is working for one when creating the topography and that employer is a legal person. Natural persons cannot obtain the rights this way.[283] In cases of commission there must be an agreement transferring the rights to the commissioner.[284]

China does not impose criminal sanctions on those that infringe on semiconductor topography rights. Civil remedies include damages, compensation and injunctions.[285]

Reverse engineering and non-commercial analysis etc. are allowed in China without the permission of the owner of the semiconductor topography rights.[286]

China allows for compulsory licensing In the case of a national emergency, or in any extraordinary state of affairs, or for the purposes of public interests, or where it is determined according to the law against unfair competition.[287]

5.9 Taiwan: Integrated Circuit Layout Protection Act[288]

Taiwan has a wide definition of the protected subject matter. They allow for single layer protection by mentioning two-dimensional circuits, do not require specific materials, do not require specific methods, and define the product as something that may be in the intermediate stages of production. The finished product is required to have an electronic function.[289]

Taiwan requires topographies to be registered in order to be granted protection. This must be done at the latest two years after first commercial exploitation. Protection last from the earlier of filing date of the registration or date of first commercial exploitation.[290]

[282] Article 3 RPLC.
[283] Article 9 RPLC.
[284] Article 11 RPLC.
[285] Article 30, 32 RPLC.
[286] Article 23 RPLC.
[287] Article 25 RPLC.
[288] Integrated Circuit Layout Protection Act: Available at Laws and Regulations Database of the Republic of China(Retrieved 2022-12-30).
[289] Article 2(1)-(2) Integrated Circuit Layout Protection Act(Hereafter ICLPA).
[290] Article 13, 15, 19 ICLPA.

Taiwan, notably unlike Japan, employs the reciprocity principle.[291]

Taiwanese law states that "*if a circuit layout is created by an employee within the scope of employment, the employer shall have the right to apply for registration*." This also applies if someone provides funding and contracts another to create a circuit layout.[292]

Taiwan maintains severe criminal regimes for technology theft due to the precarious geopolitical situation they find themselves in. The law which is most worthy of notice here is the National Security Act in its entirety. Under this law sentences of up to 12 years in prison and fines up to 100 000 000 NTD can be handed down. It focuses on so called national core technologies, which can include semiconductor technology.[293] There is however no law specifically criminalising semiconductor topography right infringement. There are civil remedies available that include damages, compensation and injunctive relief. The maximum amount that can be demanded is 5 million NTD.[294]

Taiwan grants compulsory licensing for the purposes of use to promote non-profit public interests and counteracting unfair competition.[295]

5.10 Israel: Integrated Circuits (Protection) Law, 5760-1999[296]

Israeli law defines the protected subject matter as three-dimensional, meaning individual layers are not protected. Material requirements require an "active element". Methods are not regulated and are free to choose, as indicated by the phrase "however expressed". Intermediate stages of production are protected under thanks to mention of "…*such three-dimensional disposition prepared for the manufacture*…". The finished product is required to have an electronic function.[297]

[291] Article 5 ICLPA.

[292] Article 7 ICLPA.

[293] Taiwan: National Security Act: Available at Laws and Regulations Database of the Republic of China (Retrieved 2022-12-30) See Articles 3(1) and 8 about "unauthorised reproduction" in particular.

[294] Article 29-30 ICLPA.

[295] Article 24 ICLPA.

[296] Integrated Circuits (Protection) Law, 5760-1999: Available at WIPO Lex(Retrieved 2022-12-30).

[297] Article 1 Integrated Circuits (Protection) Law, 5760—1999(hereafter ICL).

Israeli law does not require registration of the topography. The period of protection lasts from the moment of creation and until the end of the tenth year following first commercial exploitation. [298]

Israel applies the principle of reciprocity.[299]

Israel awards the rights to the topography to the employer if the employee's task include creating them and there is no contract stipulating otherwise.[300]

Israel does not impose criminal sanctions for the infringement of semiconductor rights, and refers to its standard tort laws for civil remedies.[301]

Israel allows reverse engineering and non-commercial copying etc. Commercial gains can be had from reverse engineering as long as the new topography fulfills the originality requirement itself.[302]

Compulsory licensing is allowed in Israel through application *mutatis mutandis* of the Israeli Patent Act. This allows for the granting of licenses to patents, and therefore semiconductor topographies, on the basis of necessity to medical supplies and to prevent abuse of monopolies.[303]

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[298] Article 9 ICL.

[299] Article 2(b) ICL.

[300] Article 4(b) ICL.

[301] Article 10 ICL.

[302] Article 7(1), 11 ICL.

[303] Article 13 ICL, Chapter 7 Article 1, parts 117, 120 Patents Law 5727—1967(Available at WIPO Lex) (Retrieved 2022-12-31).

6 Analysis

6.1 Identifiable problems

6.1.1 Lack of harmonisation

The underlying reason for many problems with semiconductor topography rights is insufficient harmonisation of rules between countries. As seen through for example the Paris Convention, the EPO, the Berne Convention, the Madrid Convention, the TRIPS Agreement, etc. the field of IP law fulfills its purpose better when it enjoys a great deal of harmonisation internationally. This applies to semiconductor topography rights as well. Insufficient harmonisation causes friction between jurisdictions and precipitates loopholes in international trade rules requiring crude and heavy-handed solutions, such as the export, manufacturing, and storage exceptions in Article 5(2)(a)(i-iv) of Regulation (EU) 2019/933(the SPC regulation)[304]. Accordingly, the semiconductor topography IP regime too should be as harmonised as possible to further its purpose.

An important difference between the nations in semiconductor topography rights legislation is the definition of the protected subject matter, where certain countries, the U.S. in particular, occupy a position of strict requirements that render the legislation almost useless due to requirements precluding any profitable use. The other end of the scale is occupied by countries like South Korea where the definition is much wider in regards to the details of the protected subject matter definition. Obviously such differences in one of the most fundamental aspects of IP law can cause problems if the strict definitions do not cover what the wider ones do. What happens when companies from countries with a wider definition cannot have their rights enforced by the countries with more strict definitions? From the perspective of adherents to the wide definition this would be tantamount to allowing IP infringement. Conversely, adherents of the strict definitions would see a monopoly where there is supposed to be a free market. Currently the reciprocity decision is supposed to allow countries to decide what level of differences they are prepared to accept. However, this is prevented by the fact that an implementation of the TRIPS Agreement forces the hand of country that uses the reciprocity principle in issuing such decisions.

The question of requiring registration also suffers a lack of harmonisation. Requiring rights holders to register before giving them protection establishes a clear and undeniable start to the period of protection. The

[304] Available at EURLex(Retrieved 2022-12-31).

downside is the need to engage in bureaucratic processes. This raises the question of being able to protect a chip from a non-registration countries in a countries requiring registration. Protection periods could easily fall out of phase between countries, potentially inflicting regulatory difficulties on the commercial viability of a specific topography. Furthermore, in countries that require registration where the time of registration is the only possible start of the period of protection, such as Japan, the start of this period can be strategically delayed from first commercial exploitation by the applicant. By abusing this it is possible to set a competitor up for a holdup by combining it with corporate espionage of the type that was prevalent in Silicon Valley in the 1970's and 1980's. Additionally, requiring registration everywhere makes avoiding holdups easier by for other developers of IC chips by producing registers of all other protected topographies in every jurisdiction.

The question of sanctions and remedies also suffers from this problem. By introducing different rules the countries are engaged in a race to the bottom where attracting semiconductor industry is done through allowing them to infringe semiconductor topography rights without serious consequences. In particular the question of whether to introduce criminal sanctions provides a stark difference between individual states. With accusations of tech theft now being a common cause for international political disputes this seems like an important area of legislation to investigate.

6.1.2 Obsolescence of definitions of protected subject matter

The various definitions of the protected subject matter rely on an analogy to copyrights on works of visual artistry, such as paintings. Coupled with the layer/material/method/intermediate product-framework this sets the stage for the protection of technologies that were cutting-edge around the turn of the millennium. In a short and crude sense these definitions make the topographies into little more than "paintings that are used to calculate".

However, given that the law of diminishing returns on investment will likely catch up to the current paradigm of computer technology, the miniaturisation of transistors, it is likely this framework will eventually be made obsolete. The rest of the world saw that the purpose of the technology needed to be closer to the law when they rejected the mask works used in the U.S. as the definition of the protected subject matter and instead chose to protect the topography they created *per se*. Adopting such a view again, beyond the transistor-based model as the basic component of computer technology, leads to the conclusion that this definition is a straight-jacket on the usefulness of the law. Many of the countries that adopted wide definitions of the protected subject matter house significant IC chip production today, a lesson worth remembering.

The increasing prevalence of ASICs also ties into this problem. ASICs by their very nature have a lower level of standards compliance and multi-use compatibility than other IC chips. Having the old definitions might limit the areas for which it can be profitable to develop them. While computer technology so far only has one basic method of calculation that is in widespread use, the transistor-based model, this will likely change with technology such as quantum computing.

6.1.3 Obsolescence of principle of reciprocity

The principle of reciprocity is a relic of pre-TRIPS legislation and is redundant for its original political purpose. Withholding protection for citizens of WTO members is illegal under the TRIPS Agreement. There is a case for doing away with the principle altogether and replacing it with traditional treatment on a national territorial basis. It opens up the possibility of applying case law and principles from the tried and tested national treatment principle in regards to semiconductor topography rights, thereby increasing legal certainty.

Currently the only purpose of this principle is that it offers a possibility to sanction countries that are not members of, or observers at, the WTO. The list of such countries has shrunk to a handful as of 2022, however, and includes mostly international pariahs and microstates, such as North Korea and the Vatican.

6.1.4 Period of protection too short

The increasing costs of development associated with development of new IC topographies and computing technology will increasingly strain the commercial viability of new topographies. Moore's Law hold up indefinitely, and when its end is reached the advances of computing technology will slow down. This will extend the commercial lifetime of IC chips, since their performance will not be superseded as fast as before.

The length of the semiconductor topography rights currently sits at 10 years when exploited commercially from the point of registration or first commercial use, depending on jurisdiction. This is lower than both its forebears: patents, assuming a grant process shorter than 10 years, and copyrights, which lasts for potentially more than a century. Since the potential profit from an IP right is directly proportional to the length of the period of protection extending the semiconductor's could be necessary in the future.

6.1.5 Reverse engineering disfavours rights holders

The reverse engineering exception is the part of this IP regime that allows for building on previous, still protected works. Other IP regimes have many such exceptions, such as parodies. These exception must strike a balance between the right holder's interest and potential for new creations. Under the current rules and case law, primarily the *Brooktree* decision, semiconductor IP law disfavours creator too much. This disincentivises use of these rights.

6.2 Suggested solutions

6.2.1 Appropriate forum for proposing changes

The best way to change semiconductor legislation worldwide would be through reforming the parts of the TRIPS Agreement that regulate semiconductor topography rights. This is because the TRIPS Agreement is the set of relevant rules all other sets of relevant rules implement. Changing the TRIPS Agreement is the purview of the WTO, which is therefore the appropriate forum. The WIPO should be involved as well in a consultative capacity to ensure consistency with other *sui generis* IP regimes worldwide, since IP law is their intended purview.

The suggestion on harmonising sanctions falls outside the purview of the WTO and should be addressed in a separate forum.

6.2.2 Reforming the protected subject matter definition

Creating a new definition for the protected subject matter would solve several problems at once. Inconsistent definitions of the protected subject matter could be reformed in favour of a new definition that will have less problems with inconsistent implementation. It also would accommodate the increasing technological diversity of semiconductor products that technological developments seem poised to bring about. Quantum computing, ASICs, and increased technological sophistication in general require a wide definition to fit all of them under the same definition.

The suggestion of this paper is that a more purpose-oriented definition should be adopted. This would define the protected subject matter according to the purpose of IC chips: electronic information processing. By defining semiconductor cores according to their purpose to a greater degree than their appearance the definition would be removed from the current layer/material/process framework, which is already obsolete in the jurisdiction with the most strict definitions. This would be a step toward patents on inventions, where the protected subject matter has an almost entirely purpose-oriented definition, the novel, inventive and industrially applicable technical solution to a problem.

While a paper of this magnitude is obviously insufficient research for such purposes, this paper proposes, as an initial suggestion, a new term and definition for the protected subject matter, “circuit architecture”, which should be defined as: “*The microscopic architecture of an electronic device intended to carry out electronic functions*”. This definition already has somewhat been established in the widespread requirements on the finished products to have an electronic function, as can be seen in the sample of nations in this paper. The requirements for microscopic scale would ensure that claimed architectures only include the chip itself and not the rest of the computer. Obviously, this definition is not a final version. It is only intended as an initial suggestion. It would require reviewing with engineers, legal experts and others with more knowledge on the topic before being proposed in a finished form. If a similar change was made it could be construed as supplanting the topography as the protected subjected matter for the finished product of which the topography currently is the central part, with the necessary changes to the definition made.

6.2.3 Abolishing the principle of reciprocity

The principle of reciprocity should be abolished. It can no longer serve its original purpose and by allowing governments, often independently of their legislatures and likely in violation of the TRIPS agreement, to withdraw protection from other countries introduces political risk to the semiconductor IP regime worldwide, which is hardly conducive to encouraging its use. The national treatment principle should be employed instead, since that is a tried and tested principle that is standard for other *sui generis* IP.

6.2.4 Harmonising period of protection.

The current international regime for the period of protection, when it starts, when it ends, how it relates to first commercial exploitation and registration currently suffers from a lack of harmonization. This should be rectified.

The suggested solution of this paper is that the period of protection should be the same as for patents, i.e. 20 years from point of application. This would allow topographies’ periods of protection to run concurrently with patents’, thereby offering a synergetic effect on the desire to use the IP form. Since the semiconductor industry often employs patent protection anyway, allowing for synchronisation with patents could be a way to increase the desirability of using topography rights. It might even be prudent to introduce a grant process whereby patent application can be processed concurrently with a topography right application. This would allow both to be granted at the same time, thereby synchronising the periods precisely. An additional benefit of adopting a longer protected period is that it anticipates a slowdown in the general pace of chip development, and allows chips to be profitable for a longer time in case such a slowdown extends the commercial lifetime of individual topographies beyond 10 years.

This paper also suggests making registration schemes mandatory for protection in every country. This would establish uncontested start dates for the protected periods. This change is also necessary for the previous suggestion on the period of protection. Requiring registration would also reduce workloads at courts by them not having to find out when first commercial exploitation took place of a topography that is subject of a dispute. Furthermore ubiquitous registration could also allow for the creation of a worldwide register or mutual recognition of grants on the model of the EPO. That would even further harmonise the international regime. Lastly, this change would allow for better measures on the use of these rights internationally, as mentioned in section 1.2.

The use of registration schemes has, as mentioned in section 4.5, been criticised in the literature. This criticism was on the basis of requiring too much in relation to what can be obtained. This could however also be remedied by increasing gains instead of reducing costs. Thus the underlying reasoning of that criticism is observed by this proposed solution.

6.2.5 Limiting reverse engineering exception

A more limited exception for building on works that are already protected would shift balance in favour of current right holder, thereby changing the calculus in favour of potential applicants. The current solution does this by placing the limits at the functional parts of the topography. This should be supplanted for another natural limit. A new limit could perhaps be placed along the lines of the incorporated patents used in the new topography thereby allowing the old topography to have a functional advantage for the duration of its protected period. Other solutions might be used as well, especially of the previous suggestion on reforming the protected subject matter is implemented.

6.2.6 Harmonising sanctions for infringement

Criminal sanctions need to be harmonised to avoid a race to the bottom concerning sanctions. However, since criminal law is at the core of national sovereignty the only reasonable suggestion would be to abolish criminal sanctions. Countries having them would otherwise be driving chip pirates into the arms of other countries. This can be compensated with a strong civil sanction framework, which should be harmonised as well if possible for the same reason.

It is important also to note that these changes to sanctions regimes are not something that the WTO is intended to carry out. Therefore theses changes will have to be done separately.

7 Conclusion

This paper concludes that in order to answer the research question, “What changes to legislation are appropriate to make semiconductor topography rights more attractive for 21st century semiconductor producers to use?” is:

The following changes would be appropriate:

1. Introducing registration regimes in every country.

2. Transposing the protected period used for patents: 20 years from application.

3. Abolishing the principle of reciprocity and using the principle of national treatment instead.

4. Limiting the reverse engineering exception.

5. Changing the definition of the protected subject matter to include quantum computing, ASIC’s, and the generally divergent path of computer technology.

6. Harmonising sanctions regimes to limit the prevalence haven countries for chip piracy. Criminal sanctions should be abolished and replaced with stronger civil remedies if necessary.

If these changes were to be implemented made it is the determination of this paper that this should cause an increase in registrations of topographies in excess of what the trend of technological development otherwise would explain. The laws in which semiconductor topography rights are based would likely also see increased use in courts worldwide. This would reflect and conclusively prove the increased popularity of the IP type this paper concerns.

Annex A: Table of sampled countries

Law / Country	Single layer protection	Intermediate production stage protection	Material requirement	Method requirement	Criminal sanctions
U.S.	-	-	X	X	-
Japan	X	-	X	-	X
S. Korea	X	X	X	-	X
E.U.	-	X	X	-	Not Appl.
Germany	-	X	X	-	X
U.K.	X	?*	X	-	X
Netherlands	-	X	X	-	X
France	-	X	X	-	-
Sweden	-	X	X	-	X
China	-	X	X	-	-
Taiwan	X	X	-	-	X**
Israel	-	X	X	-	-

Note: Tables are simplified. See section 5 for full details
*: The U.K. might have been in breach of the directive. See section 5.6.2
**: Taiwan National Security Act creates special situation. See section 5.8

Law / Country	Compulsory licensing	Registration requirement	Reciprocity principle enacted	Employer receives rights	Reverse eng. for comm. purpose
U.S.	-	X	X	X	X
Japan	-	X	-	X	-***
S. Korea	X	X	X	X	-***
E.U.	Not Appl.	Not Appl.	X	Not Appl.	X
Germany	X	X	X	X	X
U.K.	-	-	X	X	X
Netherlands	X	X	X	X	X
France	X	X	X	-	X
Sweden	-	-	X	X	-
China	X	X	X	X	X
Taiwan	X	X	X	X	X
Israel	X	-	X	X	X

***: It is unclear if this is allowed for commercial purposes. See Sections 5.3 and 5.4.

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