IDEA: The Journal of Law and Technology

1997

38 IDEA 105

THE NEED TO ABOLISH REGISTRATION FOR INTEGRATED CIRCUIT TOPOGRAPHIES UNDER TRIPS

CARL A. KUKKONEN, III *

* B.S. 1995 Harvey Mudd College, 1998 J.D. candidate at The George Washington University Law School. The author wishes to thank the Honorable Gerald Mossinghoff and the Honorable Ralph Oman for their advice in the preparation of this paper.

This paper was entered into the Nathan Burkan Memorial and the Federal Circuit Bar writing competitions for the 1996-1997 academic year.

I. Introduction

The integrated circuit industry has grown significantly since the commercial introduction of the transistor in 1951. n1 The global market for semiconductors in 1997 is estimated to reach $ 138.8 billion, n2 up from $ 58 billion in 1991. n3 Adequate protection for semiconductors n4 and the processes used to create them has been essential to the rapid growth of the industry worldwide. n5 Granting protection specifically for integrated

[*106] circuit layouts has helped prevent direct copying of semiconductor chips. n6 Because of theirconcern that chip piracy would become widespread and result in partial market failure, n7 semiconductor industry lobbyists in the late seventies and early eighties helped persuade the U.S. Congress to pass the first legislation specifically aimed at protecting electronic circuits embodied in semiconductor chips. n8 Industry leaders speaking before Congressional committees complained of the worldwide problem of pirated integrated circuits that allowed chips to be copied at a fraction of the cost of an original creation. n9 While patent protection had always been available for certain aspects of integrated circuits, a wholly new intellectual property regime was created specifically to protect circuit layouts, which are often ineligible for patents. This paper focuses on the evolution and status of international protection mechanisms available for integrated circuit topographies (or mask works).

[*107]

II. Protection Available to Integrated Circuit Layouts Prior to 1984

Integrated circuit layouts have always been eligible for patent protection in the United States, but the high standards for such protection (usefulness, novelty, and non-obviousness) exclude almost all integrated circuit designs. Although the processes used to manufacture circuits are often patentable, the circuit layouts rarely meet the patent code's novelty or nonobviousness requirements. n10 Advances in chip technology often involve the miniaturization of existing circuits and/or the arrangement of known circuit cells. While these advances may require large expenditures, they are viewed as "variations on a single idea," n11 and thus, fall outside patent protection. Patents are problematic for integrated circuits because their market life span is often less than the two to three years it takes to prosecute a patent in the Patent and Trademark Office.

In the late 1970s, the semiconductor industry attempted to persuade the Copyright Office to recognize either the chip masks or the chips themselves as protectable subject matter. n12 While the drawings of chip design layouts were deemed eligible for protection, n13 registration of masks and their associated chips was refused because of their utilitarian nature. n14 This persisted even though courts had upheld copyright protection of computer programs implemented within integrated

[*108] circuits. n15 Another fundamental disjunction between copyright protection and the needs of the semiconductor industry stems from the duration of the monopoly extended to the copyright holder, seventy-five years from the first publication. n16 As the economic life of most integrated circuit designs is only a few years, the semiconductor industry would not benefit from such a long exclusion of chip design and layouts from the public domain. n17

Trade secret protection is not a feasible alternative since it is difficult to maintain the requisite level of secrecy once chip designs are introduced into the stream of commerce. Trademark protection is not possible because it does not recognize chip designs as statutory subject matter, nor does it extend to integrated circuits any useful protection. Exact chip duplication could not be actionable as a false designation of origin since most integrated circuits lack any distinguishable characteristics. n18

The reason that a new type of intellectual property protection was sought for integrated circuits was that chips were being legally obtained and then copied for only a fraction of the cost of creating a wholly original layout. n19 Efforts to combat piracy, such as placing a resin on the face the integrated circuit to increase the semiconductor's immunity from copying, have failed due to advances in imaging technologies. n20 In sum, most semiconductor mask works either did not qualify for protection, or were inadequately protected under existing U.S. intellectual property laws.

[*109]

III. General Traits of Integrated Circuit Layout Protection from an International Perspective

Most of the integrated circuit layout protection legislation enacted throughout the world gives the registrant a basic core of rights. These rights often include the exclusive right to reproduce, distribute, and import the semiconductor topographies and the semiconductor chips embodying them. n21 The length of protection typically lasts for ten years after: (a) registration or (b) the first domestic sale of a chip embodying the mask work, as long as the circuit layout is registered within a certain time period after its first commercial exploitation. The recent Agreement on Trade-Related Aspects of Intellectual Property Rights ("TRIPs" or "TRIPs Agreement") allows for countries to dispense with the registration scheme as long as topography protection is at least ten years from the circuit's first commercial introduction. n22 Most regimes grant exceptions permitting infringement for educational and non-commercial uses, and also allow qualified reverse engineering. Reverse engineering is sanctioned to encourage developers to dissect a product into its functional elements and to use any acquired knowledge towards the development of improved products. n23

IV. Creating Sui Generis Legislation within the U.S.

The United States was the first country to have passed legislation protecting semiconductor chip products. Bills intended to protect integrated circuit designs were introduced as early as 1979, n24 but it was not until 1984 that the U.S. Congress passed the sui generis Semiconductor Chip Protection Act (SCPA). n25 In creating the first new intellectual

[*110] property regime in over a hundred years, Congress clearly recognized the significance of the emerging semiconductor industry. n26 Indicative of such recognition was the fact that Congressional committees heard testimony from leaders within the industry, academics, and governmental officials representing the Reagan Cabinet Council on Commerce and Trade. n27 The legislation introduced was aimed at eliminating the pirating of competitor's semiconductor chips while allowing new chips to be created after reverse engineering the competitor's circuit layout. n28 Manufacturers pushed for a statutory statement that reverse engineering does not constitute infringement because of the industry standard of second sourcing components. n29 It was believed at the time of the SCPA's adoption that because photographically copying layouts would become easier, the industry needed increased protection from pirates. n30 By providing sui generis protection outside of the patent and copyright statutes, the United States was not bound under certain provisions, such as national treatment of the Paris Convention for the Protection of Industrial Property, the Universal Copyright Convention, n31 or the Berne Convention for the Protection of Literary and Artistic Works.

[*111]

The SCPA explicitly allows for protection of foreign companies and citizens in 902(a) and 914. Section 902(a) provides that reciprocal protection may be granted to a nation which is a joint signatory, along with the U.S., to a treaty which affords protection to chip designs. n32 Section 902(a) also provides for extension of protection by Presidential proclamation to countries which extend protection to the U.S. on a basis similar to the SCPA. Section 914 provides that the Secretary of Commerce may extend protection: (1) to a foreign nation that is making good faith progress toward (i) entering into a treaty if described in 902(a), or (ii) enacting legislation similar to the SCPA; (2) government officials within the country requesting protection are not involved with active or passive encouragement of piracy; and (3) if issuing the order would promote the purpose of the SCPA with respect to protection of mask works. These reciprocity provisions were a strong enough incentive to spawn legislation in the major countries involved in the semiconductor industry. n33 Of the more than 12,000 mask works registered in the United States through 1996, approximately half were registered by foreign individuals or corporations. n34

[*112]

A. Protected Subject Matter

The SCPA defines a "mask work" as:

a series of related images, however fixed or encoded - (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 (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[.] n35

Some have interpreted this three dimensional requirement as excluding patterns in two, one, or zero dimensions from protection. n36 Technologies such as laser beam or electron beam lithography, which transfer the circuit layout patterns to a chip without the use of a mask, are not eligible for protection under a literal reading of the SCPA. n37 Nevertheless, the legislative history, combined with the qualifying phrase "however fixed or encoded," indicates that a semiconductor chip product is included within the Act regardless of its production methods. n38

A "semiconductor chip product," as defined by the SCPA, requires that two or more layers of material be deposited, etched, or removed from the chip in accordance to a predetermined pattern so as to perform electronic functions. n39 The two-layer minimum is consistent with the three-dimensional requirement under the definition of a mask work, and the predetermined-pattern restriction limits the protection of the Act to intended results. n40 For example, an etching process that accidentally creates a tip which then tunnels electrons would not be given protection. But it is unclear at what point during the development process the intended results must manifest. If the tunneling aspect of the hypothetical integrated circuit (IC) was beneficial to the operation of the circuit, then this would perhaps warrant protection. n41

[*113]

The SCPA also clearly states that any "idea, procedure, process, system, method of operation, concept, principle, or discovery" related to the creation of the mask work is not protectable. n42 Simply stated, a mask work's ideas are not protected, and it is lawful to extract them by reverse engineering (discussed infra) and to incorporate them into a new mask work. n43

B. Infringement

The SCPA states that a person will be held liable for violating any of the exclusive rights granted by the Act to an owner of a mask work. n44 These exclusive rights include:

(1) the right to reproduce the mask work by optical, electronic, or any other

means; (2) the right to import or distribute a semiconductor chip product in which

the mask work is embodied; and (3) the right to induce or knowingly to cause another person to do any of the

acts described in paragraphs (1) or (2). n45

It is difficult at this point to know precisely what acts would constitute infringement of these rights; the courts have decided on the merits only a single case involving a claim of infringement under the SCPA. n46

The Act does not define the term "reproduce," and it has yet to be clearly decided whether reproduction is limited to strict copying or a substantial similarity as put forth in Brooktree Corp. v. Advanced Micro Devices, Inc. n47 The second and third exclusive rights include the importation of a composite product containing an infringing semiconductor chip product, such as an automobile. Similar importation prohibitions were found to be objectionable during the negotiations of the Treaty on

[*114] Intellectual Property in Respect of Integrated Circuits (discussed infra) by the developing nations. As net importers of integrated circuits, developing countries found that it was impossible to monitor all of the incoming technology for pirated chips. The SCPA provides for an innocent purchaser exception as long as a reasonable royalty is paid to the owner of the registered mask work. n48 Thus, in the case of an infringing transfer of a registered semiconductor chip product (whether by sale, lease, bail or other method), liability under the SCPA is limited to the seller, lessor, bailor, or other transferor. n49

The SCPA's contributory infringement provision has been compared to patent law which finds a person liable for infringement for selling a component if that component is a material part of the invention specially made or adapted for infringing use and the component is not a staple article suitable for non-infringing use. n50

Equipment manufacturers that import infringing chips and incorporate them into final products which they later sell, directly violate both the distribution and importation rights. n51 Importing infringing chips and incorporating the chips into equipment which is only used within the importer's business violates only the importation right. n52 Additionally, importation or distribution of infringing chips which are already incorporated into their end use product violates both the importation and distribution rights of the registrant. n53 Once the registrant sells protected semiconductor chip products, those products are no longer covered by the exclusive importation right. n54

C. Defenses to Infringement

The reverse-engineering exception to infringement acknowledges and endorses the semiconductor industry practice of dissecting and analyzing circuit design layouts as a part of the process of creating compatible circuitry with identical form, fit and function ("second

[*115] sourcing"). n55 At the time of the SCPA's adoption, it was believed that permitting the exchange of new information through reverse engineering would continue to help the high-tech industry by allowing for the second sourcing of chips. n56 Reverse engineering of products is a practice that is often utilized during patent and circuit layout infringement litigation to examine a circuit for any possible infringement and to determine the form and function of specific elements.

Section 906(a) of the SCPA provides that it is not infringement for:

(1) a person to reproduce the mask work solely for the purpose of teaching, analyzing, or evaluating the concepts or techniques embodied in the mask work or the circuitry,

logic flow, or organization of components used in the mask work; or

(2) a person who performs the analysis or evaluation described in paragraph (1) to incorporate the results of such conduct in an original mask work which is made to be distributed. n57

The legislative history suggests that the narrow infringement exception can be read more broadly than the statute's language suggests. n58 The statute appears to allow reverse-engineering only for educational analysis, but not as a prelude to commercial exploitation (as evidenced by the word "solely"). Prof. Andrew Christie submits that the subject matter "concepts or techniques" and "logic flow" are part of the functional aspect of IC design, and that the "circuitry" and the "organization of components" are parts of the physical aspects of IC design such that teaching, analyzing, or evaluating all aspects of IC design are exempted under the reverse-engineering provision. n59 Furthermore, the Explanatory Memorandum to the Mathias-Leahy amendment to the SCPA clearly states that "competitors are permitted not only to study protected mask works, but also to use the results of that study to design, distribute and

[*116] import semiconductor chip products embodying their own original mask works." n60

Interestingly, the reverse-engineering defense is only available to those who have "reproduced" a protected mask work under the SCPA. n61 Therefore, even if a foreign corporation successfully raises the reverse-engineering defense, the mask work owner might still have a cause of action against importers of the chips. Unfortunately, the language of the recent TRIPs treaty does not clarify whether this defense is permissible for contributory infringers. n62

Section 906(a) is also unclear about the amount of originality required in a mask work which is reverse engineered from a registered mask work. n63 The Brooktree cases and the legislative history have applied two tests for the reverse engineering-defense for copying, the "paper trail" and "substantial identity" tests. Academics have proposed two additional tests: the "functional superiority" test and the "value-added" test. n64

The "paper trail" test merely states that a legitimate case of reverse engineering would leave extensive documentation to prove the plaintiff's legitimate evaluation efforts. This doctrine is supported by the legislative histories of the SCPA in the House and Senate. n65 "Substantial identity" would allow a level of similarity higher than substantial similarity but lower than total identity. n66 The "functional superiority" test would require the defendant to prove that the resulting mask (from a legitimate reverse-engineering dissection) is functionally superior to the regis- tered mask based on criteria that include thermal stability, decreased size, and simplified manufacturing process. n67 Finally, under the "value-added" test, a defendant would not be found liable for infringement if he

[*117] or she improved upon the protected work in some significant way. n68 Future cases may adopt oneof these standards and clarify what degree of originality is required for a new circuit layout.

V. Reciprocity as the Catalyst for Foreign Legislation

Congress included the reciprocity provision in Section 914 of the SCPA to "encourage the rapid development of a new worldwide regime for the protection of semiconductor chips." n69

A. Japan

The Electronic Industries Association of Japan filed a request with the Secretary of Commerce in October of 1984 for interim protection for Japan before the SCPA became effective. n70 Reciprocity was granted on an interim basis pending the 1985 enactment, in Japan, of the Act Concerning the Layout of a Semiconductor Integrated Circuit. n71 This legislation (known as the "Semiconductor Layout Act" or "SLA") was enacted largely to secure protection in the United States for Japanese-made semiconductor chips. Rather than including protection for semiconductor chips within the Japanese Copyright Act, the Semiconductor Layout Act, like the U.S. SCPA, also created a sui generis method of protection. n72 The SLA did away with the U.S. reciprocity requirements and simply extended protection to all non-nationals. n73 Although the SLA places few restrictions on outsiders seeking protection under the SLA,

[*118] only about 10 percent of the 7,000 registrations through the end of 1996 were from foreigners. n74

1. Protected Subject Matter

The Japanese Semiconductor Layout Act provides the registrant with ten years of protection from the date of registration for a "semiconductor integrated circuit," which is defined in Article (2)(1) as:

a product having transistors or other circuitry elements which are inseparably formed on a semiconductor material or an insulating material or inside the semiconductor material, and designed toperform an electronic circuitry function. n75

As with the SCPA, the SLA does not define the term "semiconductor integrated circuit" to include ICs made on new materials that are neither semiconductors nor insulators. Unlike the SCPA (Section 901(a)(1)), the SLA avoids referring to the manufacturing process as part of its definition of a semiconductor integrated circuit and thus clearly protects ICs created from processes other than photolithography. n76

Article 2(2) of the SLA defines a "circuit layout" as "a layout of circuitry elements and lead wires connecting such elements in a semiconductor integrated circuit." n77 The general definition of layout makes it unclear whether protection is extended to a photolithography mask or layout data embodying the circuit layout, or rather, is limited to the final product, an integrated circuit chip. This may be considered a moot point since the final product is the interest of manufacturers and pirates alike. n78 Finally, Article 12(1) of the Semiconductor Layout Act specifically designates identical, but independently created circuit layout designs as eligible for protection. n79

[*119]

2. Infringement

The SLA does not grant a circuit layout registrant any reproduction rights, n80 but rather grants the exclusive right to manufacture integrated circuits that embody the registered circuit layout and to sell, lease, or import such products. n81 Interestingly, once an integrated circuit embodying the registered circuit layout has been sold, the registrant's exclusive rights are reduced to only the ability to manufacture semiconductor chip products embodying the circuit layout. n82 The SLA makes up for this limitation in the scope of the rights it grants to registrants by casting its net broadly with respect to contributory infringement, attaching liability to more acts than any other major semiconductor chip protection regime. A person is deemed to have infringed a registered circuit layout when she, for business purposes produces, assigns, leases, displays for the purpose of assignment or lease, or imports an object which can be used solely for imitating a registered circuit layout of another. n83 An exception to contributory infringement exists when the person acted innocently and non-negligently. n84 If the person had knowledge of the infringement at the time it occurred, then she will be required to pay a reasonable royalty rate. n85

The SLA is notable not only for provisions that place no cap on damages and provides for destruction of infringing chips, but also for a provision which provides for criminal sanctions including imprisonment for up to three years and fines of as much as one million yen. n86

3. Defenses to Infringement

The Japanese Semiconductor Layout Act, like the SCPA, permits reverse engineering, and as is the case with the U.S. law, the precise boundaries of allowable reverse engineering are just as unclear. n87 Article 12(2) of the SLA provides that rights in circuit layouts do not extend to

[*120] the manufacture of a semiconductor chip that was made by utilizing a registered circuit layout to analyze or evaluate the integrated circuit. n88 Some commentators believe that a circuit layout which is the product of reverse engineering must not be identical or substantially identical to the original chip, and go on to reject the broader U.S. substantial similarity standard. n89 If this hypothesis is correct, the reverse-engineering exception suffers from a large loophole, namely that copies of layout portions might not be protected under the SLA. n90

The reverse-engineering exception in Japan apparently does not extend to commercial reproductions as the SCPA does. The SLA will not permit the inclusion in a new circuit layout of substantial portions of another protected circuit layout that was obtained through reverse engineering. n91 This is a significant restriction since it prevents the semiconductor industry in Japan from second sourcing protected chips.

B.E.C. Directive

Recognizing the growing importance of the semiconductor industry and the need for companies within the member states to have the ability to secure protection within the United States, the Council of the European Communities adopted a Directive on the Legal Protection of Topographies of Semiconductor Products ("E.C. Directive") in late 1986. This directive requires member states to adopt national legislation for the protection of integrated circuitry. n92

1. Protected Subject Matter

The reciprocity provision of the SCPA provided motivation for the 1986 issuance of the E.C. Directive, which required all member nations of the European Community to protect semiconductor topographies.

[*121] The E.C. Directive's minimum requirements for semiconductor protection almost completely mirrored the SCPA. The subject matter protected was defined in Article 1(1)(b):

the topography of a semiconductor product shall mean a series of related images, however, fixed or encoded:

(i) representing the three-dimensional pattern of the layers of which a semiconductor product iscomposed; and

(ii) in which series, each image has the pattern or part of the pattern of a surface of the semiconductor product at any stage of its manufacture. n93

An integrated circuit having a minimum of two layers, one of which is made out of a semiconductor material, is required, paralleling the SCPA's three-dimensional requirement. The E.C. Directive broadened the protection by eliminating the predetermined facet of the SCPA, though as previously discussed, it is not clear whether this is significant in practice.

The E.C. Directive's definition of a semiconductor product resembles the SPCA definition more closely than does the SLA definition. n94 Eligibility requires a predetermined three dimensional pattern with at least one layer consisting of a semiconductor material to perform an electronic function in its intermediate or final form. n95 The E.C. Directive does recognize that integrated circuits may be produced from new technologies. In addition to a layer of a semiconducting material, "one or more layers composed of conducting, insulating or semiconducting material" is required for protection. n96 Unfortunately, unlike the recent TRIPs agreement, the Directive's subject matter does not include integrated circuits made solely from superconductors, glass or other new materials. Furthermore, the excluded matter under the Directive includes any information embodied in the chip other than the topography itself, which allows for commercial reverse engineering and second sourcing.

2. Infringement

With regard to infringement, the E.C. Directive merely required that member states prohibit the reproduction of a topography and left subsequent adoption of specific standards up to each individual country.

[*122]

3. Defenses to Infringement

E.C. Directive Article 5(3) provides:

The exclusive rights ... shall not apply to reproduction for the purpose of analysing, evaluating or teaching the concepts, processes, systems or techniques embodied in the topography or the topography itself. n97

Here, the reverse-engineering exception is not granted solely for educational purposes. It would follow that eventual commercial exploitation would be a valid motive for dissecting and reproducing a similar integrated circuit layout. Again we see that only reproduction is protected so that contributory infringers would not be able to avail themselves of the reverse-engineering defense. It is not clear why the drafters decided to differentiate between the "topography" and the "topography itself." Professor Christie has suggested that this language allows reproduction for the purposes of analyzing, understanding or teaching both the functional and physical aspects of the topography's design. n98

C. United Kingdom

1. Protected Subject Matter

The 1989 amendment to the U.K. Copyright, Designs and Patents Act ("CDPA") specifically granted a greater degree of protection for integrated circuit topographies than the E.C. Directive required. The CDPA protects designs which constitute "semiconductor topographies" as long as they are an original design. n99 The first problem with this protection is that it does not extend to integrated circuits made on non-semiconductor material. While non-semiconductor substrates constitute only a very small portion of the industry, ceramics and superconductors may become more widely used in the future. Given this industry trend, the CDPA should be amended to protect the use of new technologies.

Under the CDPA: "design" means the design of any aspect of the shape or configuration (whether internal or external) of the whole or part of an article. n100

[*123] A semiconductor topography is defined under the U.K. Topography Regulations within the CDPA as:

a design within the meaning of section 213(2) of the [CDPA] which is a design of either of the following: (a) the pattern fixed or intended to be fixed, in or upon-

(i) the layer of semiconductor product, or (ii) the layer of material in the course of and for the purpose of the manufacture of a semiconductorproduct, or

(b) the arrangements of the patterns fixed, or intended to be fixed, in or upon the layers of

a semiconductor product in relation to one another. n101

The U.K. definition of topography is broader than the SCPA's and E.C. Directive's because it allows protection both for the pattern of a single layer of a semiconductor product and for the arrangement of all of the layered patterns in relation to each other. This dichotomy permits protection of all aspects of the IC design as long as the substrate of the chip is a semiconductor. n102

The CDPA arguably violates the E.C. Directive by not extending protection to intermediate forms of semiconductor products. Devices such as unprogrammed PROMs (programmable read-only memory), PALs (programmable array logic), and PLAs (programmable logic arrays) are excluded from the Topography Regulations although they may be protected outside of the semiconductor topography definition, under the design right provision. n103

The definition of a "semiconductor product" within the CDPA is similar to the SCPA's definition since it requires at least one layer to be made of a semiconductor material. n104 Integrated circuits made solely from technologies other than semiconductor materials are not included within the definition of a semiconductor product. Instruments such as a micro-hygrometer, comprised of a sole capacitive sensing face (on a ceramic substrate), used in an application such as a micro weather station, while innovative and valuable, would not be afforded protection. These

[*124] exclusions from the topography definition may still be protectable under the design right provisions ofthe CDPA. n105

Excluded matter under the CDPA is almost identical to that excluded under the SCPA in that the processes, decorative appearances, and enabling features of a circuit are excluded. n106 This is probably inconsequential since neither a chip's non-patent-eligible features nor its trade dress are likely to be copied.

2. Infringement

The exclusive rights granted under the CDPA allow the owner to reproduce the design by making articles to that design or by making a design document recording the design for the purpose of enabling such articles to be made. n107 Infringement is thus governed by the broader concept of design right. A design right provision grants protection to both the objects allowing articles to be made and to the objects made as a result of the protected work. n108 The owner of a design right is thus given a substantial amount of protection. All steps of the IC manufacturing process pertaining to the semiconductor topography itself, from the initial layout schematics to the chips themselves, are within the exclusive domain of the owner to reproduce. n109

Whereas the SCPA is silent as to what constitutes reproduction, the CDPA defines reproduction as "copying the design so as to produce articles exactly or substantially [similar] to that design." n110 This makes it clear that independent development of the same design does not

[*125] constitute infringement (again, since the SCPA is silent on this issue, it is not clear whether there isan intent requirement for a finding of infringement). n111

3. Defenses to Infringement

The CDPA includes two provisions which together allow for a reverse-engineering defense to infringement. One subsection states that infringement of a design right (this provision includes the permissible defense for an integrated circuit made out of a new technology, such as a superconductor substrate) does not include:

(a) the reproduction of a design privately for non-commercial aims; or (b) the reproduction of a design for the purpose of analysing or evaluating the design or analysing, evaluating or teaching the concepts, processes, systems or techniques embodied in it. n112

The Topography Regulations allow for greater semiconductor device protection and provide:

It is not an infringement of design right in a semiconductor topography to-(a) create another original semiconductor topography as a result of an analysis

or evaluation of the first topography or of the concepts, processes, systems or techniques embodied in it, or (b) reproduce that other topography. n113

These exceptions are very similar to the reverse-engineering provision in the SCPA and do not extend the reverse-engineering exception any further than the E.C. Directive. Any integrated circuit designs made from teachings of a reverse engineering dissection infringe a registered work under the CDPA if they are exactly or substantially similar to the design. n114 An integrated circuit design which is the product of reverse engineering will not infringe if the new circuit layout would be eligible for protection by meeting the originality requirement that the design is not "commonplace." n115

[*126]

D. Korea

The Korean semiconductor industry, as well as those of other Asian countries outside Japan, are becoming increasingly important in the global market. n116 The Korean government originally intended to enact legislation based on the ill-fated Treaty on Intellectual Property in Respect of Integrated Circuits (discussed infra), but its failure to enter into force discouraged the government from adopting similar legislation. n117 It was not until the preliminary TRIPs negotiations that the Korean government had a clear understanding of international standards of semiconductor chip protection. n118 As a result, the Act Concerning the Layout-Design of Semiconductor Integrated Circuits ("Korean Act") was passed in 1992. n119 This act was particularly imporant because the electronics industry in Korea utilizes a large number of both domestic and foreign integrated devices and sells a large number of products containing these devices, both individually and as components of larger products. n120 The Korean Act helped foster the growth of Korea both as a producer of integrated circuit products and as a gateway for worldwide distribution of semiconductor products. n121

1. Protected Subject Matter

The Korean Act includes the following definitions:

(1) "Semiconductor integrated circuit" means intermediate and final stage products manufactured to function as an electronic circuit, which are simultaneously formed in a state where circuit elements, including one or more active elements and wires connecting the elements, are inseparable from one another, on the surface of the semiconductor or insulating materials, or inside the semiconductor mate-rials.

[*127] (2) "Layout-Design" means a plane or cubic design of the circuit elements and wires which connect the elements and can be used in manufacturing a semiconductor integrated circuit. n122

The Korean Act is loosely based on the SCPA. Both intermediate and final-form products are protected, as are integrated circuits made from insulating materials. New technologies (made from insulating material) will be protected under this Act since a layout-design can be planar, and an integrated circuit needs to include only one active element (so long as it is not made on a conducting surface). The words "simultaneously formed" and "inseparable" were probably inserted to ensure that only traditional integrated circuits are protected by this Act. A printed circuit board or a similar device requiring the later integration of a component would not meet the requirements of simultaneous formation and inseparability. Single-layer integrated circuits apparently also are within the statute.

2. Infringement

A person who registers a layout-design has the exclusive right to use the layout-design for commercial purposes. n123 Use is defined as "reproduction," "manufacturing," "transferring," "displaying," "leasing" or "importing" an integrated circuit "based" on the registered layout- design. n124 The English translation using the word "based" would suggest a broader scope of protection than substantial similarity and/or substantial identity which were proposed as the U.S. standards in the legislative history of the SCPA and in the Federal Circuit's interpretation in Brooktree. n125 Persons are also not liable for any independently created infringing layout-designs. n126

3. Defenses to Infringement

The Korean Act like the other acts, allows reproduction for "education, research, or evaluation"

purposes or for non-commercial use

[*128] by an individual. n127 The Act also explicitly permits layout-designs which are created as the result of said educational, research or evaluation purposes and exempts independently created layout-designs. n128 A strict reading of the Korean Act does not allow for any type of commercial use of an integrated circuit which is the product of reverse engineering.

E. TRIPs Agreement

The first multi-continent attempt at creating uniform integrated circuit design protection took place at the World Intellectual Property Organization ("WIPO") Diplomatic Conference in Washington, D.C. in 1989. The resulting document was the WIPO Treaty on the Protection of Intellectual Property in Respect of Integrated Circuits (the "IPIC Treaty"). n129 This treaty was doomed from the outset due to opposition from the U.S. and Japan, the world's two largest producers of semiconductors. Rejection of this treaty resulted from the insistence of many developing countries that they be allowed to issue non-voluntary licenses to "safeguard a national purpose deemed to be vital by that authority," n130 as well as concerns over the lack of compensation for innocent infringement, and dissatisfaction with the dispute settlement mechanisms provided. n131

It was not until the Agreement on Trade-Related Aspects of Intellectual Property Rights concluded as part of the 1994 Uruguay Round of GATT (the "TRIPs" Agreement) that a world body including the U.S. and Japan finally adopted a uniform set of guidelines for integrated circuit protection. n132 Most of the substantive provisions of the

[*129] IPIC Treaty were incorporated into the TRIPs Agreement with the exception of the compulsory licensingprovisions. n133

1. Protected Subject Matter

The WIPO diplomatic conference in Washington, which drafted the IPIC Treaty, was an important prelude to the TRIPs Agreement, since portions of the IPIC Treaty text were included in the TRIPs Agreement. The TRIPs Agreement, although only slightly different, provides a level of protection acceptable to the WTO body (notably, the United States and Japan). The text examined here is the final version accepted by the Uruguay Round of the TRIPs negotiations. n134 As a result of multi-national participation into the IPIC Treaty's drafting, the item being protected was phrased as "layout-design (topography)" which was defined in Article 2(ii) as:

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-di-mensional disposition prepared for an integrated circuit intended for manufacture. n135

As do the SCPA and the E.C. Directive, the TRIPs Agreement protects the layers of the integrated circuit as a whole (as opposed to protecting these layer individually and as a whole, which is how they are protected under the CDPA). The phrase "however expressed" seems to allow protection of the layout- design in any form, whether it is a photolithographic mask, a design drawing or photograph, layout data or an actual IC. In addition, the "however expressed" language suggests that a chip manufactured to a set design does not have to be manifested in an integrated circuit or photolithography mask to be protected (unlike the SCPA) and that new process technologies such as electron beam lithography are within the ambit of the IPIC Treaty.

It is also important to note that the TRIPs Agreement's definition of an integrated circuit does not require that one of the layers

[*130] consist of a semiconductor material. n136 This corrects the flaw in all national legislationthat would not protect integrated circuits using ceramics, superconductors, insulators, or any other new material as a substrate. The IPIC Treaty, unlike its predecessors, did not narrow the scope of its protection by incorporating the copyright principles of idea and expression. The option to include these doctrines was instead left up to the discretion of the member nations. n137

2. Infringement

The minimum standard set out for infringement by the IPIC Treaty forbids the reproduction of a protected layout-design in part or in its entirety. n138 There is an exception to the partial copying provision which permits copying of a section that is commonplace and thus would not warrant protection on its own. n139 The provision also extends protection to forms other than an integrated circuit embodying the layout-design, such as the mask works, other forms containing the layout-design, or even a set of computer instructions guiding the electron beam lithography process. n140 Unfortunately, the treaty is silent on what constitutes reproduction, i.e., whether it requires direct copying or a substantial similarity. However, absent express requirements, the member nations can enact their own standards. n141

3. Defenses to Infringement

The IPIC Treaty provisions on reverse engineering met little resistance at the Diplomatic Conference. Based on the model set by the CDPA and the SCPA, Article 6(2)(a) provides:

[*131]

no Contracting Party shall consider unlawful the performance, without the authorisation of the holder of the right, of the act of reproduction . . . where that act is performed by a third party for private purposes or for the sole purpose of evaluation, analysis, research or teaching. n142

Like the SCPA, the TRIPs Agreement limits reverse engineering to the purposes which it enumerates. Thus, even a partially commercial motive would make this exception unavailable to a reverse engineer. This would eliminate almost all reverse engineering activity within the commercial sector. A strict reading of Article 6(2)(a) is inconsistent with paragraph (b), which, like the parallel provision in the CDPA, states that a newly created layout-design modeled after a registered layout-design does not infringe (under the reverse engineering exception) if the "not commonplace" originality requirement is met. It is still ambiguous whether there is a commercial exception. n143

VI. TRIPs and the Need to Abandon Registration Requirements

Protection from integrated circuit pirating will become essential as developing countries develop and expand their integrated circuit manufacturing capabilities. Inadequate internal research and development funding within these nations may stimulate or encourage pirating as a way to finance any needed infrastructure development. The TRIPs Agreement should therefore be expanded to allow for integrated circuit protection within all of the signatory nations without registration. n144 There has been only lukewarm response to both the U.S. and Japanese circuit layout protection acts and it is unlikely that corporations are going to invest in foreign mask works when they are susceptible to pirating. Protection should simply be granted for a minimum ten year period starting on the date of the product's worldwide introduction. Although this may create some evidentiary problems at trial, this is an effective way to ensure that these integrated circuits are protected from pirating.

[*132]

The TRIPs Agreement should also be amended to explicitly allow for commercial reverse engineering with a substantial similarity standard for infringement. Before TRIPs is fully implemented in all of the signatory nations, it might be possible for companies to take advantage of some of the subtle differences between the differing semiconductor chip layout laws. One significant loophole within the Japanese Semiconductor Layout Act is that it apparently does not allow for commercial reverse engineering. n145 Companies in closely competing sectors often rely on second sourcing to service the full range of client needs. A domestic corporation that registers layouts under the SLA could accumulate many causes of actions over the course of several years, given the frequency of commercial reverse engineering. While U.S. companies may be reluctant to litigate in Japan, any legitimate lawsuit obviously brings some leverage -which may result in the cross-licensing of valuable patents. Inconsistencies such as these exist among and between many of the major regimes, yet there appears to be no movement for remedial measures.

The subject matter of protection within TRIPs is sufficiently broad to protect integrated circuits made from materials other than the industry standard silicon. Countries with established legislation such as the U.S., Japan, and the European Community are not likely to amend their semiconductor topography acts to cover this subject matter. This may not currently be a pressing issue, but as these revolutionary advances occur, momentum will be gained, forcing the respective governments to modify their legislation.

VII. Analysis of Integrated Circuit Protection, Examining the U.S. Model

Initially haled as the single most important recent development in intellectual property, n146 the Semiconductor Chip Protection Act and the foreign legislation it spawned have been widely criticized. For a registration fee of $ 20 plus transaction costs, a mask work owner can receive protection from unscrupulous pirates and importers within the United States. This fee is insignificant compared to the millions of dollars spent developing the average integrated circuit. Furthermore, the actual registration of the mask work requires only that a sample chip be sent to the Copyright Office, thus disclosure of the circuit layout is not required for protection. Even so, major semiconductor industry participants within the U.S. have chosen not to register their mask works.

[*133]

Ironically, Intel brought suit in 1977, seeking to compel the Copyright Office to register the design of a chip, n147 and was the first company to register a mask work under the SCPA, n148 but did not register a single mask work in 1996. n149 There are several likely reasons for Intel's current lack of interest in registration. Intel is the premier CPU producer in the world with few direct competitors, and with such a strong reputation and high level of name recognition, the public is less likely to purchase personal computers with generic or alternative CPUs. Furthermore, the specialization level of most Intel products requires manufacturing processes which are beyond the capabilities of all but a few manufacturing houses. Even if a competitor was able to dissect a chip such as the media rich adapted Pentium MMX CPU and copy its multitude of layers, they simply would not have the ability to duplicate the 4.5 million transistors and the 0.35 micron CMOS process technology. n150 By the time any potential pirate would be able to produce copies, Intel will likely have released an improved version of the chip or a replacement which might make the MMX chip all but obsolete. Currently, the highest performance Pentium MMX processor runs at 200 MHz. In a matter of a few years, CPUs will be running at 1000 MHz. n151 Pirates understand the short lead time within the industry, and market factors such as those described above tend to discourage unauthorized reproductions.

Intel may simply be disenchanted with the SCPA after filing suit against Advanced Micro Devices n152 under the act in 1991. n153 Though the

[*134] outcome of the suit was never announced, unforeseen problems may have contributed to Intel's lack offaith in the Act.

It may be that the SCPA and its global progeny are simply more useful to smaller integrated circuit producers in competitive markets. Part of the impetus behind the hearings in 1979 was the fact that processing technology among semiconductor manufacturers was very similar from company to company. n154 This is no longer the case among the industry as a whole, yet manufacturers within targeted sectors need to protect against their direct competitors.

Maxim Integrated Products, Inc., n155 with headquarters in Sunnyvale, California, registered 124 mask works with the Copyright Office in 1996, nearly twice the number of registrations of the next most prolific registrants, Linear Technology Corporation (Linear Tech) and NEC (Japan), competitors of Maxim. n156 Maxim and Linear Tech are leaders within the growing analog integrated circuit market and have large catalogs of products which overlap with each other (which would indicate that both companies are second sources for each other's products). n157 Maxim spent (excluding transaction costs) less than a quarter of what it costs to acquire a patent within the U.S. to protect 124 distinct products without any disclosure to the public. Roger Borovoy, the former General Counsel of Intel, stated that "analog circuits have layouts which are much more critical than digital circuits, hence the high number [of registrations] filed by Maxim and Linear Tech and NEC, which has a big linear business." n158

[*135]

Advances in production technology have made it easier to develop digital circuitry. No longer must an engineer draw circuitry by hand and have it reduced thousands of times for a photolithography mask. The sophistication of some CAD (computer-aided design) programs eliminate the need for piracy because newer programs can completely devise circuit layouts. n159 Wires are automatically laid down, components are added, and size and cost are minimized with new software. In addition, since the adoption of the SCPA, the product processes n160 used by many manufacturers are more static, and this has allowed design parameters to be incorporated into the CAD circuit layout programs. n161 This is not to say that registration of integrated circuits consisting of digital circuitry is not useful.

Corporations often acquire patents for defensive purposes as bargaining chips in cross-licensing negotiations. n162 While an integrated circuit layout from Burr-Brown may not be useful to a giant such as Hewlett-Packard, international mask work registration licensing could be valuable between direct competitors. Perhaps Linear Tech may want to settle the recent lawsuit filed by Maxim concerning industrial espionage by cross-licensing some of its mask work portfolio along with related process patents. n163 Damages could be reduced according to the value of

[*136] the mask works offered by Linear. While only new products are likely to be attractive bargaining chips,the circuit layouts could allow Maxim to quickly produce equivalent chips embodying the protected mask work without a long lead time. Any cross-licensing necessarily requires that there is not a high level of specialization in the development process that would prevent easy transfer of mask work data among direct competitors.

The almost non-existent cost of acquiring mask work protection and the fact that public disclosure is not required for protection should be motivating factors for registration. n164 Brooktree Corporation received a $ 27 million settlement for infringement of its mask work and related patents, n165 but the lack of anticipated litigation under the SCPA has significantly decreased the efficacy of its provisions. On the other hand, some would characterize the SCPA as a success for the simple fact that there has not been much litigation. Although they cannot be examined, there have been several other major lawsuits under the SCPA which have settled out of court. n166 This would suggest that there is some faith in the Act within the industry.

The semiconductor industry during the 1970s was typified by high-volume, low-support, pin-compatible chips such as DRAMs. n167 The passage of the SCPA was largely motivated to protect these pirate-susceptible classes of chips. Competition with DRAM chips is essentially based on the market price alone and thus late-arriving pirates simply cannot make much money. n168 Shifting global production now finds Japan and Taiwan producing almost all DRAMs at low cost making pirating economically unfeasible. n169

Within some segments of the semiconductor industry, pirating is effectively non-existent due to the complexity of the technology. The shifting focus to chips with high levels of integration such as application specific integrated circuits ("ASICs"), n170 digital signal processors, and

[*137] microprocessors in some sectors has made piracy unfeasible. n171 These families of chips oftencome with a high level of manufacturer support including software, development tools, market development, and the all-important customer support. n172 The targeted customers simply will not buy chips that are unsupported by the manufacturer, forcing pirates to look elsewhere to find profitable lines.

VIII. Conclusion

It is unfortunate that changes in semiconductor layout protection are unlikely without the influence of the major semiconductor producing nations. While registration solely within the U.S. is valuable in certain sectors, it would be a significant step if major participants such as the U.S., Japan, Korea, and Taiwan abandoned their registration systems and automatically granted layout protection for a minimum of ten years from the date of a chip's first commercial exploitation. Developing countries with nonexistent or fledgling integrated circuit production capabilities are currently not a source of pirated chips, but this could very well change in the future when we see a more widespread base of integrated circuit producers. As multinational integrated circuit protection currently stands, manufacturers are simply not going to register their layouts in the multitude of countries producing integrated circuits. Mandating automatic protection, rather than requiring registration, would eliminate this problem and provide a foundation from which to eliminate piracy of integrated circuits.

n1 Francisco A. Moris, Semiconductors: The Building Blocks of the Information Revolution, MONTHLY LAB. REV., Aug. 1996 at 6, 12.

n2 According to Semiconductor Industry Association estimates. Barriers Fall, USA TODAY, Oct. 31, 1996, at 1B.

n3 ANDREW CHRISTIE, INTEGRATED CIRCUITS AND THEIR CONTENTS: INTERNATIONAL PROTECTION 4 (1995).

n4 In this paper, "semiconductor" may be used synonymously with "integrated circuits" although it is recognized that integrated circuits may be made from other materials. "Mask works," "topographies," and "circuit layouts" may also be used synonymously except in the sections containing particularized analyses of individual nations' subject matter and infringement provisions within their integrated circuit layout protection laws.

n5 According to World Semiconductor Trade Statistics: Global Consumption in Major Markets, Worldwide Sales Market Sector 1996 1999 America's market 32.3% 32.5% Japan market 26.1% 23.5% Asia Pacific market* 20.8% 23.7% European market 20.8% 20.4% * Includes Singapore, Korea, China, Taiwan PR NEWSWIRE, Oct. 30, 1996

n6 See generally John G. Rauch, The Realities of Our Times: The Semiconductor Chip Protection Act of 1984 and the Evolution of the Semiconductor Industry, 3 FORDHAM ENT. MEDIA & INTELL. PROP. L.F. 403 (1993).

n7 Piracy circumvents the natural lead times within the industry, tending to dry up investment in innovative but unpatentable applications of science. J.H. Reichman, Symposium: Toward a Third Intellectual Property Paradigm; Legal Hybrids Between the Patent and Copyright Paradigms, *94 COLUM. L. REV. 2432, 2442 (1994).*

n8 Semiconductor Chip Protection Act of 1984 302, *17 U.S.C. 901*-914 (1996).

n9 Intel Corporation reduced the price of its 8088 chips from the introduction price of $ 60 to $ 30 after the chip had been copied. Zilog was forced to reduce the price of its Z-80 chip by 60 percent after pirated copies had been introduced. David I. Wilson & James A. LaBarre, The Semiconductor Chip Protection Act of 1984: A Preliminary Analysis, 67 J. PAT. & TRADEMARK OFF. SOC'Y 57, 60 n.14 (1985). At Congressional hearings in 1983, Intel estimated that the cost of developing a family of chips to be $ 80 million and the cost to copy was approximately $ 100,000. Rauch, supra note 6, at 410-12.

n10 The Semiconductor Chip Protection Act of 1983: Hearing on S. 1201 Before the Subcomm. on Patents, Copyrights, and Trademarks of the Senate Comm. on the Judiciary, 98th Cong. 126 (1983) (statement of Arthur Miller, Harvard University Professor of Law). "As a practical matter, the layout of a chip, as embodied in a mask, will rarely, if ever, satisfy this [novelty and non-obviousness] standard of invention. A chip may be the product of millions of dollars and thousands of hours effort, but it is the result of hard work, not invention."

n11 Terril G. Lewis, Symposioum: Legal Issues in the Information Revolution: Comment: Semiconductor Chip Process Protection, HOUS. L. REV. 555, 564 (1995).

n12 See generally Russel T. Wong, The Semiconductor Chip Protection Act, 67 J. PAT. & TRADEMARK OFF. SOC'Y 530 (1985).

n13 Pamela Samuelson, Symposium: The Semiconductor Chip Protection Act of 1984 and its Lessons: Creating a New Kind of Intellectual Property: Applying the Lessons of the Chip Law to Computer Programs, *70 MINN. L. REV. 471, 477 (1985).* Copyright protection of layout designs did not prevent manufacturers from making actual integrated circuits from the protected drawings or layout design.

n14 Copyright Protection for Semiconductor Chips: Hearing on H.R. 1028 Before the Subcomm. on Courts, Civil Liberties, and the Administration of Justice of the Comm. on the Judiciary, House Judiciary Comm., 98th Cong. 66 (1983) (statement of the Hon. Gerald J. Mossinghoff, Assistant Secretary of Commerce and Commissioner of Patent and Trademarks; Chairman, Working Group on Intellectual Property, Cabinet Council on Commerce and Trade, The White House).

n15 *Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240, 219 U.S.P.Q. (BNA) 113 (3d Cir. 1983),* cert. dismissed, *464 U.S. 1033 (1984)* (court held that a program embedded on a ROM (Read Only Memory) Chip was eligible for a copyright). A recent federal court decision in Australia held that the importation of a video game as a computer program stored on the integrated circuit was not an infringement of the copyright in the underlying computer program. The "Sega Cases" Sega Enterprises Ltd. v. Gottlieb Electronics Pty Ltd. and Sega Enterprises Ltd. v. Galaxy Electronics Pty Limited, IPASIA, November 1996, at 12.

n16 Copyright Act of 1976 101, *17 U.S.C. 302*(c) (1996).

n17 J.H. Reichman, Charting the Collapse of the Patent-Copyright Dichotomy: Premises for a Restructured International Intellectual Property System, *13 CARDOZO ARTS & ENT. L.J. 475 (1993).*

n18 James Chesser, Semiconductor Chip Protection: Changing roles for Copyright and Competition, *71 VA. L. REV. 249, 260 (Mar. 1985).*

n19 See note 9.

n20 Hrayr A. Sayadian, Substantial Similarity and Reverse Engineering Under the Semiconductor Chip Protection Act: Their Bite is Worse than Their Bark!, 19 IOWA J. CORP. L. 103, 104 (Fall, 1993).

n21 Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, art. 36, *33 I.L.M. 81*.

n22 Id. art. 38.

n23 Leland S. Paynter, Networking Software Copyrights and the Semiconductor Chip Protection Act: A Study of Legal Protection for Application Specific Integrated Circuit Technology, *27 IND. L. REV. 415, 422 (1993).*

n24 House of Representatives Bill H.R. 1007 (1979) (The bill proposed to expand the definition of graphic and pictorial works within the U.S. Copyright Act to include masks used for photolithography and their resulting patterns. It is believed that the Bill failed in part because of its failure to allow a 'reverse engineering' defense).

n25 Semiconductor Chip Protection Act of 1984 302, *17 U.S.C. 901*-914 (1996). The Intel 27C256 PROM chip was the first mask work registered under the SCPA and Digital Equipment Corp. was the first company to register a wholly new design under the act. Mitch Betts, Intel First to Register Design under Chip Protection Act, COMPUTERWORLD, Jan. 21, 1985, at 90; DEC Registers First New Chip, COMPUTERWORLD, July 29, 1985, at 12.

n26 The last prior act was the Trademark Act. Ch. 138, 21 Stat. 502 (1881) after similar acts were found to be unconstitutional in *The Trademark Cases, 100 U.S. 82 (1879).*

n27 See generally Hearing, supra note 14.

n28 Critics of the SCPA state that it is often more important to be the first company to reach the market and, thus, pirates making a late entry make little if any money. Michael Ladras and James Otteson, The National Law Journal, Jan. 24, 1994, at S8. "[A] competitor's right to shorten the routine innovator's natural lead time by lawful forms of reverse-engineering stimulates investment in research and development looking to future and technical improvements." Reichman, supra note 17, at 490.

n29 Manufacturers prefer to have multiple sources for any components that they incorporate into their products to insure that they will not face any unforeseen supply problems.

n30 Taken from an electronic communication between the author and Roger Borovoy, Mar. 10, 1997. Mr. Borovoy is a partner at Fish & Richardson P.C., Menlo Park, CA. Vice President, General Counsel and Secretary of Intel Corporation, Santa

Clara, California, 1974-1983. Expert witness in Advanced Micro Devices v. Brooktree Corp.

n31 "The Universal Copyright Convention mandates national treatment protection; if chips were protected by copyright the United States would have been required to protect foreign chip designs, while receiving no assurance of similar protection for U.S. works." Louis A. Schapiro, The Role of Intellectual Property Protection and International Competitiveness, *58 ANTITRUST L.J. 569, 578 (1989).*

n32 See generally Jay A. Erstling, The Semiconductor Chip Protection Act and its Impact on the International Protection of Chip Designs, 15 RUTGERS COMPUTER & TECH L.J. 303, 310-11 (1989).

n33 Prior to the Uruguay Round Agreement Act implementing the TRIPS Treaty, the Secretary of Commerce in 1994 had extended interim protection under the SCPA to: The Member States of the European Community, Australia, Austria, Canada, Finland, Japan, Sweden, and Switzerland. *59 Fed. Reg. 30773, 30774 (1994).*

n34 Unpublished Copyright Office Statistics (on file with author). Number of Mask Work Registrations for 1985-1996: United States 6363 Japan 5370 United Kingdom 176 Taiwan 166 Canada 138 Netherlands 85 Germany 48 Others 75 Total: 12,421

n35 Semiconductor Chip Protection Act of 1984 302, *17 U.S.C. 901* (1996).

n36 CHRISTIE, supra note 3, at 24-25 (This would exclude quantum device ICs and rudimentary devices consisting of only one level).

n37 Charles R. McManis, International Protection for Semiconductor Chip Designs and the Standard of Judicial Review of Presidential Proclamations Issued Pursuant to The Semiconductor Chip Protection Act of 1984, 22 GEO. WASH. J. INT'L L. & ECON. 331, 338 (1988).

n38 Id.

n39 901.

n40 CHRISTIE, supra note 3, at 24.

n41 See generally CHRISTIE, supra note 3, at 25.

n42 902.

n43 DONALD S. CHISUM & MICHAEL A. JACOBS, UNDERSTANDING INTELLECTUAL PROPERTY 6D[4][B][iv] (1992).

n44 910(a).

n45 905.

n46 *Brooktree Corp. v. Advanced Micro Devices, Inc., 977 F.2d 1555, 24 U.S.P.Q.2d (BNA) 1401 (Fed. Cir. 1992)* (The U.S. Court of Appeals for the Federal Circuit affirmed a $ 27 million judgment in favor of Brooktree for mask work and patent infringement. AMD was found to have copied Brooktree's core SRAM cell from the protected mask work 6,000 times in their layout. AMD unsuccessfully raised a reverse engineering defense while demonstrating a significant paper trail associated with its efforts).

n47 *Id. at 1564, 24 U.S.P.Q.2d (BNA) at 1406.*

n48 907.

n49 905.

n50 CHISUM, supra note 43, 2E[2][c].

n51 Richard H. Stern, Symposium: The Semiconductor Chip Protection Act of 1984 and its Lessons: Determining Liability for Infringement of Mask Work Rights Under the Semiconductor Chip Protection Act, *70 MINN. L. REV. 271, 277-78 (1985).*

n52 STERN, supra note 51, at 277-78.

n53 Id. at 278.

n54 Id. at 281.

n55 CHISUM, supra note 43, 6D[4][b][i].

n56 Chesser, supra note 18, at 284-85 (referencing S. REP. NO. 98-425, at 21-22 (1984), which explains that it is not feasible for a chip pirate to appropriate only part of the design and contribute original engineering for the rest because the costs of the original engineering deprive the pirate of the economic benefit of copying. Furthermore, the design of the chip is usually sufficiently integrated such that a copy of only part of the design will not result in a usable product without the addition of significant R&D by the pirate.)

n57 Semiconductor Chip Protection Act of 1984 302, *17 U.S.C. 906*(a) (1996).

n58 130 CONG. REC. 28,960 (daily ed. Oct. 3, 1984).

n59 CHRISTIE, supra note 3, at 142.

n60 130 CONG. REC. 28,960.

n61 906.

n62 Agreement on Trade-Related Aspects of Intellectual Property Rights, supra note 21.

n63 See generally Harold R. Brown, Fear and Loathing of the Paper Trail: Originality in Products of Reverse Engineering Under the Semiconductor Chip Protection Act as Analogized to the Fair Use of Nonfiction Literary Works, *41 SYRACUSE L. REV. 985 (1990).*

n64 Lee Hsu, Reverse Engineering Under the Semiconductor Chip Protection Act: Complications for Standard of Infringement, 5 ALB. L.J. SCI. & TECH. 249, 263 (1996).

n65 Id.; S. REP. NO. 98-425, at 22 (1984); 130 CONG. REC. 28,960; H.R. REP. NO. 98-781, at 21 (1984).

n66 Hsu, supra note 64, at 267.

n67 Id. at 270 (quoting Leo J. Raskind, Reverse Engineering, Unfair Competition, and Fair Use, *70 MINN. L. REV. 385, 402 (1985)).*

n68 Id. at 272 (quoting Kathryn A. Fugere, Note, Reverse Engineering Under the Semiconductor Chip Protection Act: An Argument in Favor of a "Value-Added Approach", *22 GOLDEN GATE U. L. REV. 515, 525-27 (1992)).*

n69 133 CONG. REC. E1283 (daily ed. Apr. 6, 1987) (statement of the Hon. Robert W. Kastenmeier of Wisconsin).

n70 Erstling, supra note 32, at 322; Issuance of Interim Order, Interim Protection for Mask Works of Japanese Nationals, Domiciliaries and Sovereign Authorities, *50 FED. REG. 24,668 (1985).*

n71 2 TERUO DOI, INTERNATIONAL COPYRIGHT LAW AND PRACTICE 9[b][i] (Paul E. Geller ed. 1996).

n72 Id.

n73 Jeffrey P. Cunard, How to Protect Technology That's Transferred to Japan; Computer Software, Semiconductor Chip "Mask Works", E. ASIAN EXECUTIVE REP., Feb. 15, 1990, at 7.

n74 There were 6,901 circuit layout registrations under the SLA as of January 1, 1997. Registrants include: Japan (6194), U.S.A. (542), Netherlands (91), Germany (48), United Kingdom (16). Statistics on Circuit Layout Right (Mask Work) Registration, from the Industrial Property Cooperation Center (IPCC), Tokyo (on file with author).

n75 DOI, supra note 71 at 9[b][ii].

n76 Z. Kitagawa, Protection of the Circuit Layout of Semiconductor Integrated Circuits in Japan, INDUS. PROP. 351, 354 (1986).

n77 DOI, supra note 71 at 9[b][ii].

n78 See generally Jonathan H. Lemberg, Note, Semiconductor Protection: Foreign Responses to a U.S. Initiative, *25 COLUM. J. TRANSNAT'L L. 345, 360-361 (1987).*

n79 Cunard, supra note 73.

n80 Id.

n81 DOI, supra note 71 at 9[b][v].

n82 Id.

n83 Kitagawa, supra note 76, at 352.

n84 Id.

n85 Id.

n86 Erstling, supra note 32, at 324-25.

n87 Act Concerning the Circuit Layout of a Semiconductor Integrated Circuit 1985, art. 12 (Japan).

n88 Cunard, supra note 73, at 7.

n89 Kitagawa, supra note 76, at 357.

n90 Id.

n91 Lemberg, supra note 78, at 362.

n92 The U.K. implemented the Directive by way of the Design Right (Semiconductor Topographies) Regulations 1989 ... which modify the operation of the design right provisions (Part III) of the Copyright, Designs and Patents Act 1988.... Other technologically developed countries, including Australia, Sweden, and Switzerland, had implemented sui generis protection in substantially the same form as the SCPA by the end of the decade. CHRISTIE, supra note 3, at 5-6 (footnote omitted).

n93 Directive on the Legal Protection of Topographies of Semiconductor Products on 16 December 1986 ('E.C. Directive'), Article 1(1)(b); 87/54/EEC, O.J. No. L. 24/36.

n94 E.C. Directive, Article 1(1)(a).

n95 Id.

n96 Id.

n97 E.C. Directive, Article 5(3).

n98 CHRISTIE, supra note 3, at 142.

n99 Copyright, Designs and Patents Act 1988, 213 (U.K.).

n100 Copyright, Designs and Patents Act 1988, 213(1) (U.K.).

n101 Design Right (Semiconductor Topographies) Regulations 1989, 2(1) (U.K.).

n102 CHRISTIE, supra note 3, at 33.

n103 Id. at 37.

n104 The U.K. Topography Regulations provide that a semiconductor product is: an article the purpose, or one of the purposes, of which is the performance of an electronic function and which consists of two or more layers, at least one of which is composed of semiconducting material and in or upon one or more of which is fixed a pattern appertaining to that or another function[.] Design Right (Semiconductor Topographies) Regulations 1989, 2(1) (U.K.).

n105 CHRISTIE, supra note 3, at 32.

n106 Section 213(3) of the CDPA states that a design right does not subsist in: (a) a method or principle or construction, (b) features of shape or configuration of an article which-(i) enable the article to be connected to, or placed in, around or against, another article so that either may perform its function, or (ii) are dependent upon the appearance of another article of which the article is intended by the designer to form an integral part, or (c) surface decoration.

n107 Copyright, Designs and Patents Act 1988, 213(3) (U.K.). Copyright, Designs and Patents Act 1988, 226 (U.K.).

n108 CHRISTIE, supra note 3, at 105.

n109 Id.

n110 Copyright, Designs and Patents Act 1988, 226 (U.K.).

n111 CHRISTIE, supra note 3, at 105-06.

n112 U.K. Copyright, Design and Patents Act 226(1)(A).

n113 Design Right (Semiconductor Topographies) Regulations 1989, 8(4) (U.K.).

n114 CHRISTIE, supra note 3, at 151-52 Copyright, Designs and Patents Act 1988, 226(2) (U.K.).

n115 Copyright, Designs and Patents Act 1988, 213(4) (U.K.).

n116 According to a 1994 article by Sang-Hyun Song & Seong-Ki Kim, The Impact of Multilateral Trade Negotiations on Intellectual Property Laws in Korea, 13 UCLA PAC. BASIN L.J. 118, 127 (1994).

n117 Unpublished analysis from the law firm of Kim & Chang, Seoul, Korea (on file with author).

n118 Song, supra note 116, at 127-28.

n119 There were 223 registrations under this act from the period of September 1993 to March 1996. The top five registrants were: Samsung Electronics (75), Sanyo Electric (52), Hyundai Electronics Industry (17), Hitachi (14) and Sony (13). Unpublished analysis from the law firm of Kim & Chang, Seoul, Korea (on file with author).

n120 Id.

n121 Id.

n122 Act Concerning the Layout-Design of Semiconductor Integrated Circuits, art. 2 (Korea).

n123 Id. at art. 8.

n124 Id. at art. 2(4).

n125 *Brooktree Corp. v. Advanced Micro Devices Inc., 977 F.2d 1555, 1564, 24 U.S.P.Q.2d (BNA) 1401, 1406 (Fed. Cir. 1992).*

n126 Act Concerning the Layout-Design of Semiconductor Integrated Circuits, art. 9(1)(3) (Korea).

n127 Id. at art. 9.

n128 Id.

n129 For a copy of the treaty, see Treaty on Intellectual Property in Respect of Integrated Circuits (the Washington Convention), *15 LOY. L.A. ENT. L.J. 367 (1995).*

n130 INTELLECTUAL PROPERTY READING MATERIAL, 33.73 World Intellectual Property Organization Publication No. 476(e) (1995); Compulsory licensing was favored by smaller producers of integrated circuits such as Korea which provided in their Semiconductor Chip Layout-Design Protection Act that the Minister of Trade, Industry and Resources may award a non-exclusive license if the Minister finds that the awarding of a non-voluntary license is necessary for national security, to protect free competition, or to prevent an abuse of the layout-design rights. Song, supra note 116, at 129.

n131 Kim Feuerstein, Chips Off the Trade Bloc: International Harmonization of the Laws on Semiconductor Chips, 2 FORDHAM ENT. & MEDIA & INTELL. PROP. L.F. 137, 150 (Spring, 1992).

n132 Even the Supreme Soviet of the Russian Federation has passed a law protecting integrated circuit layouts. "On the Protection of Integrated Circuit Topology" was passed in 1992 with hopes of Russia gaining some legitimacy within the international community. Christopher Boffey, Avtorskoye Pravo [Author's Law]: the Reform of Russian Copyright Law Toward an International Standard, 18 MD. J. INT'L L. & TRADE 77, 105 (1994.

n133 INTELLECTUAL PROPERTY READING MATERIAL, 33.86 World Intellectual Property Organization Publication No. 476(e) (1995).

n134 Agreement on Trade-Related Aspects of Intellectual Property Rights, supra note 21.

n135 Treaty on Intellectual Property in Respect of Integrated Circuits, opened for signature, May 26, 1989, art. 2(ii), *28 I.L.M. 1484*.

n136 [An] "integrated circuit" means a product, in its final form or an intermediate form, in which the elements, at least one of which is an active element, and some ore all of the interconnections are integrally formed in and/or on a piece of material and which is intended to perform and electronic function[.] Treaty on Intellectual Property in Respect of Integrated Circuits, supra note 135, art. 2(i).

n137 Id at art 4.

n138 Id. at art. 6(1)(a)(i).

n139 Id. at art. 3(2).

n140 Id. at art. 6.

n141 Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, art. 1, *33 I.L.M. 81*.

n142 Id. at art. 6(2).

n143 Taiwan, a non-signatory of TRIPS recently promulgated the Integrated Circuit Layout Protection Law ("ICLPL") in August, 1995 which took effect early in 1996. This act and other advances in intellectual property in Taiwan are part of the country's attempt to join the World Trade Organization. Sofia Wu, Taiwan Completes Legislation of IC Layout Law, CENT. NEWS AGENCY, July 14, 1995.

n144 Article 38 of TRIPS allows signatory nations to grant protection without registration for a term of ten years from the date of first commercial exploitation.

n145 Lemberg, supra note 78, at 362.

n146 McManis, supra note 37, at 331.

n147 Intel Corp. v. Ringer, C77-2848 (N.D. Cal. 1978); The case was dismissed without prejudice with the Copyright Office filing the chip in its correspondence records without a sample deposit. Wilson, supra note 9 at 63.

n148 See note 25.

n149 Unpublished Copyright Office Statistics (on file with author). Intel registered one mask work under the SCPA in 1995.

n150 Intel Introduces the Pentium Processor with MMX Technology: Intel MMX Technology Delivers Improved PC Performance, Software and New Capabilities for Desktop and Mobile Computers, BUSINESS WIRE, Jan. 8, 1997.

n151 Given the rapid evolution in CPU performance, it is likely that the market will see the introduction of 1,000 MHz processors within the next several years. When that occurs, it will make the latest Pentium MMX announcement look like ancient history. ... [Digital Equipment Corporation's] product roadmap also indicates plans for a 15 million-transistor, 500MHz CPU to be introduced sometime in 1997. Mike Griffith, Another Slant on Intel's Dominance, ELECTRONIC NEWS, Jan. 27, 1997, at 10.

n152 Advanced Micro Devices, Inc. registered 27 mask works in 1996 and 21 in 1995. Unpublished Copyright Office Statistics (on file with author).

n153 See note 46.

n154 Rauch, supra note 6, at 428.

n155 Maxim was recently classified as the 42nd fastest growing company within the U.S. America's Fastest Growing Companies; The Top 100, FORTUNE, Oct. 14, 1996, at 90.

n156 The top ten registrants in 1996 are: Maxim Integrated Products (124), NEC Japan (77), Integrated Device Technology (74), Linear Tech Corp. (69), Cirrus Logic (55), Matsushita Electronics (51), TelCom Semiconductor (40), Winbond Electronics (45), Toshiba (34), and National Semiconductor (33). Unpublished Copyright Office Statistics (on file with author).

n157 Demonstrative of the level of competition between the two companies is the fact that FBI agents in San Francisco recently arrested a former employee of a Japanese subsidiary of Linear Tech for wire fraud. The suspect posed as a representative of Toshiba and received draft sheets for an integrated circuit known as the MAX1630 used in regulating voltage on batteries in notebook computers for analysis by Toshiba engineers. Maxim sued Linear Technology in a California court in February 1996, accusing it of stealing product secrets, according to news reports. FBI Arrests Japanese Man on High-tech Fraud Charge, REUTERS N. AM. WIRE, March 8, 1997.

n158 See note 30.

n159 Lewis, supra note 11, at 566.

n160 CMOS [Complementary Metal-Oxide-Silicon] which has been the design technology of choice for several years, is becoming mature. With maturity, the process and design secrets distinguishing different companies' CMOS technologies become fewer and less profound. CMOS technology is becoming a commodity. As it does, slavish line-by-line copying becomes possible. Steven P. Kasch, The Semiconductor Chip Protection Act: Past, Present, and Future, 7 HIGH TECH. L.J. 71, 103 (1992).

n161 "The stability of CMOS has allowed its design principles to be incorporated into computer systems that can automatically generate whole sections of the design layout that will eventually be incorporated into the mask work during fabrication." Lewis, supra note 11, at 568; See also Kasch, supra note 161, at 103-04.

n162 Chesser, supra note 18, at 265.

n163 See note 157. Mask work protection may also prove to be a useful tool against the increasing problems associated with Asian organized crime. Advanced chip manufacturing equipment and processes are being increasingly stolen from North America and Europe and smuggled back to East Asia. Prepared Testimony of Willard H. Myers, III, Center for the Study of Asian Organized Crime, Huntingdon Valley, Pennsylvania, Before the House Judiciary Comm. Subcomm. on Crime, the Growing Threat of International Organized Crime, Current Trends in Transnational Chinese Enterprise Crime, FED. NEWS SERVICE, Jan. 25, 1996. Circuit layout protection violation, while admittedly minimal in respect to the original offense of theft, may help prevent the copying of chips intended to be made with the stolen equipment or processes.

n164 This is unlike patent law which extends a 20 year monopoly in exchange for the inventors consent to disclose the invention for the enrichment of the public domain.

n165 *Brooktree Corp. v. Advanced Micro Devices, Inc., 977 F.2d 1555, 24 U.S.P.Q.2d (BNA) 1401 (Fed. Cir. 1992).*

n166 See note 46.

n167 Rauch, supra note 6, at 430.

n168 CHRISTIE, supra note 3, at 16.

n169 Rauch, supra note 6, at 430.

n170 ASICs require the purchaser to define some functional characteristics before using the component. The undefined state of ASICs resembles a pre-printed form with unfilled blanks. To fill in the blanks, the ASIC purchaser describes custom electronic features with special software. Dedicated equipment translates these software descriptions into physical changes to the ASIC chip. Paynter, supra note 23, at 416 (footnote omitted).

n171 Rauch, supra note 6, at 429-30.

n172 Id.