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"SEMICONDUCTOR CHIP PROTECTION"

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Semiconductor Chip Protection

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When a new technology is born, the law can give it protection in one of two ways. Either an existing law can be modified by judicial interpretation or by legislation, or a completely new form of protection can be developed.

The protection of semiconductor chips has been an example of a crafting of a new sort of protection. In fact, this is the first completely new form of protection for intellectual property to be designed in the twentieth century.[1]

Five years ago, no country had specific protection for semiconductor chips. Now, at least thirty countries have such protection, and a diplomatic conference held in May 1989 has adopted a treaty to protect such chips.[2]

We will consider what semiconductor chips are, why they need protection, and how that protection has been given by the laws of various countries and by treaty. We will also look at the likelihood of the newly-drafted treaty becoming a viable international means for the protection of such semiconductor chips.

What semiconductor chips are

A visual examination of a semiconductor chip would show a featureless gray piece of material, usually square or rectangular in shape. Usually, however, it is not possible to examine a semiconductor chip, as the chip, when it passes into the hands of consumers, is usually encapsulated in a protective covering. Through the covering extend a number of electrical

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connections or leads joining the chip to the computer in which it is intended to be used.

The inner structure of the apparently featureless gray material is in fact very complex. Within this material, there are a number of different layers and tiny, carefully measured amounts of impurities introduced in selected areas. The result is a complex electric circuit (known as an "integrated circuit" because the circuit elements are integrally formed with the chip material). Chips can have their circuits designed for many different purposes. For example, some chips are memory chips, which store the information within a computer. Others are processing chips, which contain within them the computer programs which tell a computer how to operate on data.

The complex circuitry patterns within the chip can be very difficult and expensive to design. Often, they contain tens of thousands of individual circuit elements. The speed with which the chip functions, its effectiveness, and its ease of manufacture, all depend on chip design. Designing a chip is a complicated mixture of science and intuition.

The cost of designing a chip varies widely. There are some very simple chips, known as "semi-customized" chips, in which most of the design is done by computer. Frequently, design costs on these are only in the order of a few thousand dollars or tens of thousands of dollars. On the other hand, complicated chips frequently are very expensive to develop. In one recent case[3] the plaintiff alleged that it had spent $3.8 million U.S. developing a chip to convert digital information for display on a video screen. Where the chip involved is a central processing chip for a new computer, the costs may easily be in the tens of millions of dollars. Testimony before the United States Senate in 1979 placed the design cost of a new family of processing chips at nearly $100 million U.S. dollars.[4]

Once the design cost has been incurred, the cost of making the chips is small by comparison. Therefore, there is a temptation to wait until a competitor has incurred the cost of developing a successful chip, and then to copy it.

The way in which chips are made has a bearing on the protection obtainable and on the way new laws have been structured to protect chips. A chip is built up in layers. A conductive pattern is imposed on the chip to form one layer. This layer is then covered in part by a nonreactive substance, and the exposed parts may be subjected to chemicals to introduce desired impurities or coated or removed. Then, the nonreactive substance may be all or partially removed and another layer can be deposited on the chip. This process is repeated to make a number of different layers.

In early chip making technology, the conductive pattern was imposed by shining light through a mask to make a pattern of light and shadow on the material of the chip. The portions of the chip which were hit by light underwent a chemical reaction. The chip was treated further and the surface would dissolve off in accordance with the pattern of light and shadow.[5]

In recent years, newer techniques have been developed which do not require exposure to light through masks. One of these techniques involves shooting a beam of electrons at the surface of the semiconductor material to make the required conductive pattern.

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Prior Means of Protecting Chips

Two conventional forms of intellectual property protection may, in the absence of any new legislation, give some protection to chips. These are copyright and patent.

Copyright protects literary, artistic, musical and dramatic works. The works do not need to have had a literary, artistic, musical or dramatic purpose. Thus, a law text is protected even though its author may not have had literary aspirations, and a blueprint is protected as an artistic work, even though there was no intention to make something beautiful.

The mask through which light is exposed to the surface of the chip would clearly fall in the category of artistic works. In most countries of the world, they would be therefore protected by copyright. [6]Similarly, the collection of data (known as a "data set") which is used to direct the electron beam to make a pattern on the surface of the chip would be a literary work. Thus, there is already some protection for the things used to make the chip by means of copyright.

It is less certain whether the chip itself is covered by copyright. When examined, the chip is a featureless gray blob, and it is not possible to see the internal structure of the chip without the use of an electron microscope and without destroying the chip in the process. Thus, it may be difficult to say that the chip itself is an artistic work. The chip may contain a literary work (for example a collection of data or a computer program). However, the chip is not itself the literary work, but merely its carrier, just as the pages of a book serve to carry the typeface in which a literary work can be expressed.

Copyright does not of course protect the process or sequence of steps in making the chip, although such process or

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sequence of steps is absolutely critical to get a worthwhile chip.

Thus, although there is some possible protection from copyright, not all aspects of a chip are protected.

Patent protection is granted for any new and useful invention of a process, composition of matter or machine.[7] Court interpretation of such protection has required that the invention be unobvious, in the sense of requiring something that would not occur to the normal person skilled in the art. The requirement is sometimes formulated in terms of there being a "stroke of genius". In the production of most chips, there is nothing unobvious or unexpected, amounting to a stroke of genius. Instead, there is just a great deal of hard work and trial and error, in making the best possible design and sequence of steps.

Thus, neither patents nor copyrights are completely satisfactory for protection of chips. Further, because the chip industry is developing so rapidly, some concern has arisen as to the possible inappropriateness of the long periods of protection granted by patents and copyright.[8]

Steps Towards a Specialized Law

In the late 1970's and early 1980's, the United States was the world leader in chip development. United States companies became nervous about the prospect of having their chips copied, and lobbied for a specialized form of chip protection.

A result of this lobbying effort was the United States Semiconductor Chip Protection Act of 1984.[9] This act defines a new concept called a "mask work". The mask work is defined as a series of related images (however fixed or encoded) having or representing the three dimensional pattern of metallic,

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insulating or semiconductor materials present or removed from the layers of the semiconductor chip product. The images in the series are required to be related to one another in that each image has the pattern of the surface once formed of the semiconductor chip product. A mask work is said to be fixed in a semiconductor chip product when the mask work can be perceived or reproduced from the product.

The concept of a mask work is drawn from the fact that the prevailing technology at the time that the United States act was drafted was the exposure to light of the chip through a series of masks. Each "related image" of the mask work was related to the form of chip which existed after exposure through a particular mask the chemical treatment which followed such exposure.

The United States act requires registration of mask works in order to give protection. Protection lasts for ten years from either the date of registration or the date of commercial exploitation, whichever occurs first.

The United States act has three interesting provisions, namely those dealing with innocent infringement, reverse engineering and mutuality.

The innocent infringement provision[10] applies to persons who purchase semiconductor chip products in good faith and without having notice of protection. It does not apply to manufacturers. The innocent purchaser incurs no liability with respect to the importation or the distribution of units before he has notice of protection with respect to the mask work embodied in the chips which he distributes. He is only liable for a reasonable royalty or any products which he has purchased before notice, and imports or distributes after notice.

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This provision is an attempt to balance of the rights of the manufacturer to prevent copying against the rights of a purchaser without notice. The provision is capable of misuse, as purchasers can buy inexpensive chips from offshore manufacturers without having to inquire as to whether the chips are in fact copies. As world trade in chips advances, and chips become more and more of a staple commodity item, this exception to infringement can be expected to become relatively important.

The second interesting provision involves reverse engineering. It permits reproduction of a mask work 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. Once this has been done, the result of the work can be incorporated in an original mask work, which can then be distributed.

There has been considerable discussion as to what is meant by the reverse engineering provision. There is something analogous in copyright, in that copyright does not extend to cover an idea, but only its mode of expression. Thus, it is permitted to examine a copyright work, extract the idea, and re-express it in different terms all without infringing copyright. Reverse engineering might be considered to be a similar approach with respect to chips. However, it is unclear at the moment how different the resulting chip must be in order to escape reverse engineering.

The only case which has yet occurred under the United States Act dealt with reverse engineering.[11] This case involved an interlocutory injection application alleging misappropriation of mask works in two chips. The defendant adduced evidence of reverse engineering. The parties agreed that where reverse

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engineering is shown, the chip owner can prevail only if the two designs are substantially identical. In this case, there was a dispute as to whether the defendant had in fact reached his design by reverse engineering, or whether he had in fact copied. Further, there was a dispute as to whether the chips were in fact substantially identical, having regard to the fact that the parts allegedly copied comprised about 80% of the transistors in the chip but only about 35% of the chip area.

As the matter was only an interlocutory injection, the court needed only to find that the plaintiff had failed to make a showing of a strong likelihood of success. Thus, no concluded opinion was expressed on what the reverse engineering provision of the statute means.

The third interesting provision in the United States Act is the mutuality provision[12]. The United States Act extends protection to the mask works of United States nationals, to nationals of the countries which are members of a treaty of which the United States is also a member, and to nationals of countries which the United States considers gives protection on substantially the same basis as the United States. There are also transitional provisions[13] to give interim protection to nationals of countries which the United States considers to be making bona fide efforts to protect chips.

International Steps Toward Protection

The United States is not only a large manufacturer of chips, but is also the largest user of them worldwide. When the United States created a semiconductor chip protection act, manufacturers in many other countries immediately wanted protection for their chips in the United States market under that act. Other countries rushed to pass laws protecting chips. Because of the mutuality provisions of the United States act, this required that their home countries move to protect chips as well. A Japanese law[14] was promulgated less than six months after the United States law. Within another seven months, there was a proposal from the Commission of the European Economic Community. This culminated in a European Council directive,[15] requiring all European Community Countries to adopt norms of protection.

Many countries with only peripheral or nonexistent chip industries also adopted laws very quickly. At present, over thirty countries have semiconductor chip protection laws.

Apart from the United States, no major country adopted the idea of a "mask work" in its legislation. It was recognized by the time that most of the other laws were passed that the concept of a mask work reflected only one possible technology to make chips. Thus, if the chip is made by directing a beam of electrons at the surface of layers, there is no "mask" used.

For this reason, most of the more recent laws have adopted another approach, based on what is called "chip topography". Although the definition varies slightly between countries, it generally relates to the three dimensional pattern of the layers of which a semiconductor product is composed. It is independent of the means by which those layers are created.

The Integrated Circuit Treaty

The World Intellectual Property Organization (WIPO) is the United Nations agency which deals with intellectual property. As early as 1985 WIPO started work on drafting a treaty for the protection of integrated circuits.

A number of meetings of experts from around the world were held, and a diplomatic conference was called in Washington

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D.C. in May 1989. Over sixty countries were present at the conference. At the end of the conference, the treaty was passed by a vote of 49 to 2. Five countries abstained, including Canada.[16]

One would think that a treaty passed by such a large majority would have no difficulty being ratified. However, the two countries who voted against the treaty were the United States and Japan. Together, these two countries account for most of the chip manufacture in the world.

It is instructive to see why the vote went this way. The United States and Japan sought strong chip protection, but other countries wanted provisions which would help develop their own chip industries. The major points of contention were compulsory licenses, the duration of protection and the settlements of disputes.

The treaty as passed had a strong compulsory licence provision, permitting the granting of nonexclusive licenses "in circumstances that are not ordinary" where the proposed licensee has sought unsuccessfully to get a voluntary licence and where the granting authority considers the granting of a compulsory licence "to be necessary to safeguard a national purpose deemed to be vital by that authority."[17] Compulsory licenses are also permitted after the holding of a hearing for purposes of securing free competition.[18]

The United States and Japan were both concerned that the compulsory licence provisions could be used by other nations to emasculate protection of really important chips. For example, if a new generation of computers, based on a particular type of chip, were developed, then some countries might well think that compulsory licenses should be granted to "safeguard a national purpose" of keeping their country competitive.

The second issue of concern to Japan and the United States was the period of protection. As leaders in chip production, both the United States and Japan wanted a minimum protection period of protection of ten years. Many countries who were net chip importers sought a five year protection period. Ultimately, the treaty as passed provided for a minimum eight year protection period.[19]

The third area of disagreement was the settlement of disputes. The United States and Japan wanted a binding way to make treaty members abide by the treaty. However, as passed, the treaty merely sets up an assembly of treaty members. Any dispute between members must first be the subject of consultation between the members involved. If this is not satisfactory to solve the problem, the assembly convenes a panel of treaty members, which provides a written report. The assembly can then make nonbinding recommendations to the parties of the dispute, but has no power to punish or expel a member. This provision concerned the United States and Japan, as they felt that members could flout their obligations under the treaty, while still gaining the benefits of protection for their nationals in other treaty countries.[20]

There is real doubt as to how effective the treaty will be. Since the United States and Japan are the world's largest chip manufacturing and using nations, any treaty which does not include them is not likely to be very effective. Further, if the United States does not recognize treaty members as granting equivalent protection to the United States, one of the treaty's purposes in qualifying countries under the mutuality provisions of the United States statute will be lost. It is of course possible that Japan and the United States could adhere to the

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treaty even though they voted against it, but this does not seem very likely at the present time.

What may arise is a series of bilateral mutuality provisions, with the treaty playing no real role.

The Situation in Canada

Canada is a net importer of semiconductor chips. Thus, it is probably to our benefit to have a relatively short protection period. We do have a few manufacturers, and these would like protection in the United States, which is a major and nearby market. In order to benefit from the reciprocity provisions of the United States statute, we must give protection as well.

Canada's reaction to the United States Semiconductor Chip Protection Act was initially to commission a research report on the protection of semiconductor chips by Canadian law[21]. An economic assessment of the desirability of new law was also prepared.[22] A discussion paper then was drafted with proposals for legislation and circulated for comment by the public.[23] Based on these initiatives, Canadian industry sought and obtained interim protection in the United States for Canadian manufactured chips under the interim protection provisions of the United States Act.

Following the receipt of comments on the discussion paper, a proposed act was drafted, and was also circulated to interested persons for comment. The act will be discussed in detail at a meeting of the government Intellectual Property Advisory Committee (IPAC) on August 31, 1989.

Although the act has been drafted to be as compatible as possible with the treaty, it also envisages the setting up of

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reciprocal protection arrangements with individual other countries.

Conclusion

The protection of semiconductor chips, and the integrated circuits contained on them, shows how quickly legislation can be enacted to deal with a new technology, and how the acts of one major producer and user nation with regard to a new technology can affect the world-wide protection of that technology. It also shows the ways that differences of opinion can arise internationally between user nations and supplier nations as regards the extent of legal protection, and the implications that such differences of opinion have on the form of protection and the form of international agreements which are enacted.

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ENDNOTES

1. The principal international conventions on patents and copyright came into existence in 1883 and 1886 respectively. In England, for example, patent protection was codified by the Statute of Monopolies in 1624, trademark protection rose through common law cases at least as early as the eighteenth century and the first design statute dates from 1787.

2. Treaty on Intellectual Property in Respect of Integrated Circuits, adopted by a diplomatic conference sponsored by the World Intellectual Property Organization (WIPO) at Washington, D.C., May 8-26, 1989, WIPO document ITIC/DC/46 [hereinafter called the "WIPO Treaty"].

3. Brooktree Corporation v. Advanced Micro Devices Inc. (U.S.D.C. So Dis Cal), decision December 13, 1988, court No. 88-1750-E.

4. Senate Report 98-425, note 20.

5. A photographic negative is made in the same way. Light hits the negative, and the negative is developed to remove the surface covering from the parts where the light has not hit.

6. Such masks would probably now be protected in Canada because of the recent amendment to section 46 of the Canadian Copyright Act. See S.C. 1988 c. 15 s. 11.

7. The definitions of patentable subject matter vary slightly from country to country, but the statement made is a good summary. As examples of definitions, see Canada, The Patent Act, R.S.C. 1985 c. T-4, s. 2, (definition of "invention"), and United States, 35 U.S.C. s. 101.

8. In most countries, patents grant protection for twenty years from the date of application. An exception is the United States which grants a protection of seventeen years from the date of issue. Canada is in the process of changing from the U.S. system to the system in force in most countries. In most countries, copyright protection lasts for life of the author plus fifty years.

9. 17 U.S.C., Chapter 9 effective November 8, 1984.

10. 17 USC 90C

11. Brooktree Corporation v. Advanced Micro Devices Inc., Supra note 3.

12. U.S. 17 USC 902.

13. 17 USC 917

14. Law No. 43 of 1985, promulgated May 31, 1985

15. European Communities Council Directive of December 16, 1986 on the Legal Protection of Topographies of Semiconductor Products.

16. The other countries that abstained were Sweden, Switzerland, Liechtenstein and the Holy See, none of which is a major force in semiconductor chip protection. Several countries were not represented at the time of the final vote, although they attended the earlier part of the conference.

17. WIPO Treaty Article 86(3).

18. In Canada, The Competition Act provides for the granting of compulsory licenses under other intellectual property statues where an intellectual property right is used to injure or restrain unduly trade or commerce, or as a price maintenance tool, or, a petition tribunal finds that there may be reduction of competition as the result of a specialization agreement.

See Competition Act, R.S.C. 1985, c. T-34, sections 32, 61(1) and 86(4).

19. WIPO Treaty, Article 8.

20. WIPO Treaty, Article 14.

21. Research Report on Production of Semiconductor Chips by Canadian Law (November 1985), prepared for Consumer and Corporate Affairs Canada, by George E. Fisk (unpublished).

22. Economic Assessment on the Desirability of Enacting Intellectual Property Legislation for Semiconductor Chips, (1986,) research report prepared for Consumer and Corporate Affairs Canada, by Price Waterhouse Management Consultants (unpublished).

23. Semiconductor Chip Protection in Canada - Proposals for Legislation, Consumer and Corporate Affairs Canada, April 1987.

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BRIEF BIOGRAPHY

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George E. Fisk is a partner in the firm of Gowling, Strathy & Henderson where he practises Computer Law and Intellectual Property Law.

Mr. Fisk has represented clients in a large number of cases involving computer program copyrights, and was retained by the Federal Government to prepare draft legislation on the protection of semiconductor chips. He taught Intellectual Property at the University of Ottawa for eight years, and taught a course on "Law and Policy: High Technology Issues" at that University for two years. He is Associate Editor of the Canadian Patent Reporter, Co-Chairman of the Software Legislation Sub-Comittee of the Licensing Executives Society, and Editor of the Fifth Edition of Fox "Canadian Patent Law and Practice" (to be published in 1990).

Mr. Fisk has written approximately 40 papers in the fields of computer law, patents, trade marks and copyright, and has spoken on related topics to many groups including the Patent and Trademark Institute of Canada, the Advocates Society, The Canadian Bar Association, The Practising Law Institute and the American Intellectual Property Law Association. He has been sent by the World Intellectual Property Organization (a United Nations agency) to lecture on licensing of computer programmes in Thailand and Korea. He was also sent by that organization to give a five-day licensing course in Vietnam.