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REMARKS: By Mr. Edwards of California

STATEMENT OF CONGRESSMAN DON EDWARDS UPON INTRODUCTION OF LEGISLATION TO PROTECT RESEARCH ON INTEGRATED CIRCUIT CHIPS

HON. DON EDWARDS

OF CALIFORNIA

IN THE HOUSE OF REPRESENTATIVES

Thursday, October 12, 1978

● Mr. EDWARDS of California. Mr. Speaker, I am introducing legislation today to protect the rights of inventors and companies engaged in researching applications of semiconductor technology. There is widespread concern in the industry that protection under the copyright laws is necessary to prevent the pirating of imprinted design patterns by foreign competitors.

The proposed bill will amend section 101 of the Copyright Act of 1976 to clarify that copyright protection is available for the imprinted design patterns on semiconductor chips. The Register of Copyrights has denied registration under the present act. She takes the position that these patterns cannot be identified separately from the utilitarian aspects of the chip.

The integrated circuit, a combination of transistors and other electronic circuit elements on a single chip of silicon, was invented in the late 1950's. Commercial integrated circuits (known as "IC's") first were available in 1961. The technology expanded rapidly and in 1971, a fledgling Santa Clara company produced an entire computer on a single silicon chip. The "computer-on-a-chip", technically called the microprocessor or microcomputer, is revolutionizing the electronics industry. The February 20, 1978 issue of Time Magazine quoted an industry analyst as saying that the microcomputer chip: "Will have more impact on our society in the next 20 years than any other invention." Already, the microcomputer is being used in microwave ovens, refrigerators, electric ranges, cash registers, taxi meters, typewriters, television sets, automobiles, hi-fi's, home computers, and, by the end of this decade, probably will be found in virtually every home and business electronic unit produced. To meet the 1980 pollution standards, for example, every automobile will have at least one microcomputer.

The integrated circuit was a Santa Clara Valley development. First marketed in 1961, IC's are already a $5 billion worldwide industry.

Only over the last few years has foreign competition become a factor in the state-of-the-art, leading edge portion of the business. The microcomputer started from nothing in 1971. Last year's microcomputer sales were $235 million and are expected to grow 50 percent annually, to exceed $800 million by 1981.

The "chips", as they are dubbed, are becoming larger, more complex—and increasingly expensive to develop. The first microcomputer chip in 1971 was a tiny square slightly larger than one-tenth inch on each side containing 2,250 transistors. The microcomputer of 1978 is a chip about one-quarter inch square and contains over 30,000 transistors. It is more powerful than the IBM 1401—the workhorse business computer of the 1960's.

Producing silicon chips of such complexity requires a substantial chip layout design effort. Layout designers start from a schematic circuit diagram of the microcomputer. The conversion to a chip layout design is done by hand at a drafting table. The completed, hand-drawn layout of a 30,000 transistor chip almost fills a room 20 feet square. Ten designer-years of effort were required to transform that circuit diagram into the chip layout.

The finished layout design is traced by an electronic tracing device connected to a computer. The traced data is stored by the computer onto magnetic tape. This tape is used directly in an electronically controlled camera to photographically produce the masks or tooling which will be used to imprint the design onto the chip. These masks have been photographically reduced in size from the layout drawing by a factor of one one-millionth in area.

Making the layout design is not merely drafting. It requires considerable creativity. The designer must cram the 30,000 transistors and their intricate, rabbit-warren interconnections into an absolutely minimum area in order to minimize the chip size. If the chip is too large, existing production technologies will be incapable of economically producing a sufficient number of fully functioning chips. In other words, the "yield" will be too low to be practical.

At the same time as the cost of creating new layout designs is skyrocketing, the technology for copying them is improving. Ironically, electronic equipment making use of these very microcomputer chips is being used by chip pirates to copy them. Better lenses, better photomicrographic techniques, and better control electronics are becoming available for taking superb blowup pictures of the tiny chip. As soon as the company which did the original design puts a chip on the market, the chip pirate purchases it, removes any impeding coatings on the chip surface, and sends it to a specialized and trained photomicrographer (often

in Japan) to make blowup photos of the layout design. Typically, a blowup 800 to 1,000 times the original chip size is used. The chip pirate (or a commercial business which offers chip-copying as a service) electronically traces the photographic blowup and feeds the design information into a computer in exactly the same way as the original layout designer did from his own original design drawings. The techniques and the equipment are exactly the same.

While the American economy is built on competition, unfair competition—and chip pirating is just that—has a negative impact on the semiconductor industry. Unless a reasonable return on investment can be made on a new chip, the American semiconductor firms will not make the investments to design them. Chip pirates drastically curtail the innovator's product leadtime (during which development costs must be recovered) by quickly reaping the fruits of the design. Copying is cheap, designing is dear. If the pirating practices are allowed to continue, the American semiconductor industry no longer will be willing to finance new chip designs. The Japanese companies, financed by the Japanese Government and banks, do not need the profit levels we require to attract capital. They will, by our default, take over the original chip design efforts and eventually the entire market. It was our willingness heretofore to finance creativity which put us in our present leadership position. If our willingness to invest goes, semiconductor leadership inevitably will default to the Japanese, just like video cassette recorders.

Patent protection is not enough. Just as copyright protection on musical works, which has always existed, was not enough to protect against record and tape pirates, patent protection on the circuit designs used in semiconductor chips is insufficient to protect against chip pirates. Patents usually cover narrow circuitry aspects of the chips. These inventions are widely diffused throughout the industry and the world. The semiconductor industry has been characterized by broad cross-licensing of patents, either free or for relatively nominal payments. Patents have been no impediment to its dramatic growth.

The proposed amendment to the Copyright Act will not interfere with the normal "reverse engineering" prevalent in the industry. "Reverse engineering" requires only one or a very few photographs of the layers of the chip. These photographs are analyzed by engineers who can trace the circuit schematic. The circuit schematic is turned over to a chip designed to prepare an original topographic layout design. The taking of these photographs for study and analysis, but not for duplicating, is clearly permitted within the "Fair Use" doctrine set forth in section 107 of the 1976 Copyright Act.

Another practice prevalent in the industry which would not be prohibited by the proposed amendment is the copying of portions of an integrated circuit chip. For example, it is common to copy a single transistor, or a cell of transistors to incorporate these into one's own original topographic layout design. Such copies would be de minimus and thus would not be protectable as "original" works of authorship under the Copyright Act.

The purpose of the proposed amendment to the Copyright Act is to clarify that the creative efforts of highly skilled and highly paid chip layout designers will be legally protected. Much the same as the 1972 amendment to the copyright law was required to prevent phonographic record pirating, the semiconductor industry needs an amendment to the 1976 Copyright Act to prevent "chip pirating".

Chip layout design is a form of unpatentable intellectual property. The 1976 Copyright statute should be clarified to insure its protection.●