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INTERNAL REVENUE SERVICE
WASHINGTON, D.C. 20224
December 23, 1999

Number: **200013017**
Release Date: 3/31/2000
UILC: 41.00-00

TL-N-4277-99
CC:DOM:FS:P&SI

INTERNAL REVENUE SERVICE NATIONAL OFFICE FIELD SERVICE ADVICE

MEMORANDUM FOR SAN JOSE DISTRICT COUNSEL

FROM: Assistant Chief Counsel (Field Service)
CC:DOM:FS

SUBJECT: Research Credit

This Field Service Advice responds to your memorandum dated October 19, 1999. Field Service Advice is not binding on Examination or Appeals and is not a final case determination. This document is not to be cited as precedent.

LEGEND:

T	=
Year 1	=
Year 2	=
Year 3	=

ISSUES:

1. Whether expenses incurred in the manufacture of a wafer and mask set containing a prototype integrated circuit design are eligible for the credit under Internal Revenue Code § 41.
2. When does research end for purposes of section 41.

CONCLUSION:

1. The wafer and mask set are property of a character subject to the allowance for depreciation and therefore are not supplies; accordingly, the expenses for the manufacture of the wafer and mask set are not eligible for the credit under section 41.
2. Under the facts of this case, research ends for purposes of section 41 when the research no longer comes within the definition of "qualified research."

FACTS:

T designs, develops, manufactures and markets
integrated circuits
. The majority of T's employees are engineers

In an integrated circuit, the majority of the circuit area contains the circuitry required to perform the circuit function, which can be memory, logic, or memory and logic. Before fabricating an integrated circuit, a specific function and design must be established. The circuit designer will start with a block functioning diagram of the circuit. High levels of computer testing and simulation are required before the design is accepted. After the design is accepted, the block diagram is translated to a schematic diagram. The diagram shows the number and location of the various circuit components.

While T designs and markets integrated circuit products, it does not have its own fabrication or manufacturing plants to manufacture its integrated circuits. Rather, T relies on third-party contract manufacturers to manufacture and package its products, including new products or processes in the development stage. The third party manufactures the wafer and mask set according to T's specifications. Specifically, T would provide the third-party manufacturer with design files and related information and the third-party manufacturer would prepare the wafers. Such third-party manufacturers and assembling plants are located primarily overseas.

Integrated circuits are formed on a blank wafer surface of silicon. A wafer of silicon is a business-card thick disk between four and 12 inches in diameter. The area on a wafer occupied by the integrated circuit is called a chip or a die. Generally, there are several layers to each semi-conductor chip. To make each layer, a blue print, or photomask (mask), is made. From the mask, the pattern of the circuit is placed onto the silicon wafer. It can take up to 10 to 12 hours to manufacture one layer of a mask with 10 million transistors. Thus, it can take a mask manufacturer, running its equipment 24 hours a day, almost a week to manufacture a mask set. As the integrated circuit designs get more advanced, larger and more complex patterns are required to be drawn on the masks. Each new design or reduction in the size of the die requires new mask tooling. It typically takes a manufacturer running the fabrication plant 24 hours a day six weeks to manufacture a finished wafer containing a new chip design. In general, the fabrication of integrated circuits onto the blank silicon wafer is an extremely complex and time-consuming process.

When the wafer is finished, it is inspected. A map is generated by a computer showing the location of good and bad chips. The wafer is cut apart into individual die or chips and the good chips are selected for packaging.

The third-party wafer manufacturer, to be profitable, has a minimum run requirement. In addition, when designing a new chip, T requires prototype wafers

“First silicon” is the first set of silicon wafers produced for a new chip design. This is the first time T’s engineers are able to see the physical results of their product and process design decisions. The number of wafers and wafer lots fabricated during first silicon will vary based upon various engineering criteria.

T performs limited functionality tests on the first silicon to begin to assess the extent to which the initial product and process design choices were successful. The results of these tests begin the process of determining the need for design changes.

Three steps are used to measure whether the product meets T’s overall function requirements. In product and process qualification, the new component is tested to determine if it meets certain standards regarding its ability to operate in specific environments and whether T’s standards for expected product life are met. Yield, which measures the number of good die out of the total die per wafer, along with product characterization is a primary determinant of whether a new design meets T’s basic functional and economic requirements.

Design changes are made throughout the development process in an attempt to increase the number of fully functional die per wafer. Design changes typically result in mask changes. The new wafers are then tested, the need for design changes identified, and the process begins again. Thus, the development process involves testing, circuit redesign, mask change notice, purchase of new wafers fabricated pursuant to the mask change notice, and the testing of the newly fabricated wafers. This process continues until the yield that establishes commercial manufacturability is reached.

In Year 1, Year 2, and Year 3, T claimed the research credit under section 41. In computing the credit, it included as a supply the cost of the wafers from first silicon to the time the chip was in volume production, yield was stable and minimum engineering support was required.

LAW AND ANALYSIS

Expenses Incurred in Manufacture of Wafer and Mask

A taxpayer is allowed a credit against tax for qualified research expenses paid or incurred in a trade or business. I.R.C. §§ 38(a), 41(a). The amount of the credit is equal to 20 percent of the excess of the taxpayer's qualified research expenses for the taxable year over the base amount and 20 percent of the taxpayer's basic research payments. I.R.C. § 41(a). Qualified research expenses include amounts which are paid or incurred by the taxpayer during the taxable year in carrying on any trade or business of the taxpayer for in-house research and contract research expenses. I.R.C. § 41(b)(1).

Contract research expenses means 65 percent of any amount paid or incurred by the taxpayer to any person (other than an employee of the taxpayer) for qualified research. I.R.C. § 41(b)(3)(A). Qualified research is research:

(A) with respect to which expenditures may be treated as expenses under section 174;

(B) which is undertaken for the purpose of discovering information which is technological in nature, and the application of which is intended to be useful in the development of a new or improved business component of the taxpayer, and

(C) substantially all of the activities of which constitute elements of a process of experimentation for research that relates to a new or improved function, performance, or reliability or quality and does not relate to style, taste, cosmetic, or seasonal design factors.

I.R.C. §§ 41(d)(1), (d)(3). Several activities are specifically excluded from the definition of qualified research, including research conducted outside the United States. I.R.C. § 41(d)(4)(F).

T relies on third-party contract manufacturers to manufacture and package its products, including new products or processes in the development stage. The third party manufactures the wafer and mask set according to T's design specifications. Specifically, T would provide the manufacturer with design files and related information and the third-party manufacturer would prepare the wafers. It is our opinion that, based on the facts provided, the contract between T and the third-party manufacturer is not a contract for services, but rather is a contract for wafers.

Furthermore, even if the contract could be construed as a contract for services, there are no facts which would indicate the services provided by the third-party manufacturer qualify as contract research expenses. Because the third-party manufacturer is manufacturing wafers according to T's design specifications, the services it provides do not involve discovering information which is technological in nature, the application of which is intended to be useful in the development of a new or improved business component of T, or that substantially all of the third-party manufacturer's activities constitute elements of a process of experimentation for research that relates to a new or improved function, performance, reliability or quality. Thus, regardless of the extensiveness of the services provided by the third-party manufacturer in producing the chip, to the extent any amounts could be considered as paid for its services, such amounts are not amounts paid or incurred by T for qualified research. Accordingly, the amounts paid by T to the third-party manufacturer for services could not constitute contract research expenses. See I.R.C. §§ 41(b)(3)(A), (d)(1). Finally, even to the extent the services provided by an overseas third-party manufacturer could be considered as coming within the definition of qualified research, such amounts would not constitute qualified research as research conducted outside the United States is specifically excluded from the term "qualified research." I.R.C. § 41(d)(4)(F).

Qualified research expenses include amounts which are paid or incurred by the taxpayer during the taxable year in carrying on any trade or business of the taxpayer for in-house research expenses. I.R.C. § 41(b)(1)(A). In-house research expenses include expenses for any amount paid or incurred for supplies used in the conduct of qualified research. I.R.C. § 41(b)(2)(A)(ii). Supplies means any tangible property other than land or improvements to land and property of a character subject to the allowance for depreciation. I.R.C. § 41(b)(2)(C). The Committee Report provides that--

Property which is of a character subject to the depreciation allowance is not eligible for the credit whether or not amounts of depreciation are deductible during the year and whether or not the cost of such property can be “expensed.”

H. R. REP. NO. 201, 97th Cong., 1st Sess at 118 (1981). Accordingly, any tangible property of a character subject to the depreciation allowance, regardless of whether the taxpayer is claiming depreciation with respect to the property, is not a supply.

Chips are tangible property of a character subject to the allowance for depreciation. See I.R.C. §§ 167, 168. Accordingly, regardless of whether the chips are depreciable property in the hands of T, because they are of a character subject to the allowance for depreciation, they are not a supply for purposes of the research credit. Accordingly, the expenses for the manufacture of the wafer and mask set are not eligible for the credit under section 41.

Completion of Research for Purposes of Section 41

Qualified research expenses include amounts which are paid or incurred by the taxpayer during the taxable year in carrying on any trade or business of the taxpayer for in-house research and contract research expenses. I.R.C. § 41(b)(1). In-house research expenses include any wages paid or incurred to an employee for qualified services performed by such employee. I.R.C. § 41(b)(2)(A)(i). Qualified services means services consisting of engaging in qualified research or engaging in the direct supervision or direct support of research activities which constitute qualified research. I.R.C. § 41(b)(2)(B). Qualified research is research:

(A) with respect to which expenditures may be treated as expenses under section 174;

(B) which is undertaken for the purpose of discovering information which is technological in nature, and the application of which is intended to be useful in the development of a new or improved business component of the taxpayer, and

(C) substantially all of the activities of which constitute elements of a process of experimentation for research that relates to a new or improved function, performance, or reliability or quality and does not relate to style, taste, cosmetic, or seasonal design factors.

I.R.C. §§ 41(d)(1), (d)(3).

Under section 174, research and experimental expenses means--

expenditures incurred in connection with the taxpayer's trade or business which represent research and development costs in the experimental or laboratory sense. The term generally includes all such costs incident to the development or improvement of a product. The term includes the costs of obtaining a patent, such as attorneys' fees expended in making and perfecting a patent application. Expenditures represent research and development costs in the experimental or laboratory sense if they are for activities intended to discover information that would eliminate uncertainty concerning the development or improvement of a product. Uncertainty exists if the information available to the taxpayer does not establish the capability or method for developing or improving the product or the appropriate design of the product. Whether expenditures qualify as research or experimental expenditures depends on the nature of the activity to which the expenditures relate, not the nature of the product or improvement being developed or the level of technological advancement the product or improvement represents.

Treas. Reg. § 1.174-2(a)(1). In determining if the expenses at issue are research or experimental expenditures as used in section 174, the focus of the inquiry is on the nature of the activity to which the expenditures relate, *i.e.*, the determination of the design, methodology and development of the wafer or mask, not the nature of the wafer or mask or level of technological advancement. Treas. Reg. § 1.174-2(a)(1).

Section 174 covers costs incurred in developing the concept of a product. Rev. Rul. 73-275, 1973-1 C.B. 134. It does not include expenditures for the acquisition or improvement of depreciable property. I.R.C. § 174(c); Treas. Reg. § 1.174-2(b). See also *Mayrath v. Commissioner*, 41 T.C. 582, 590 (1964), aff'd, 357 F.2d 209 (5th Cir. 1966) (regulatory definition of research or experimental expenditures is reasonable and consistent with the intent of the statute to limit deductions to those

expenditures of an investigative nature expended in developing the concept of a model or product); Agro Science Co. v. Commissioner, T.C. Memo. 1989-687, aff'd, 927 F.2d 213 (5th Cir. 1991) (contracts did not require the taxpayer to invent or design any product); Kollsman Instrument Corp. v. Commissioner, T.C. Memo. 1986-66, aff'd, 870 F.2d 89 (2d Cir. 1989) (contracts did not require the taxpayer to invent or design any product). Section 174 does not apply to any expenditure for an acquisition or improvement of depreciable property. I.R.C. § 174(c); Treas. Reg. § 1.174-2(b)(1), (4).

The determination of whether the research is undertaken for the purpose of discovering information that is technological in nature depends on whether the process of experimentation utilized in the research fundamentally relies on principles of the physical or biological sciences, engineering, or computer science--in which case the information is deemed technological in nature--or on other principles, such as those of economics--in which case the information is not to be treated as technological in nature. H.R. CONF. REP. NO. 841, 99th Cong., 2d Sess at II-71 (1986).

The term "process of experimentation" is a process involving the evaluation of more than one alternative designed to achieve a result where the means of achieving that result is uncertain at the outset. This may involve developing one or more hypotheses, testing and analyzing those hypotheses (through, for example, modeling or simulation), and refining or discarding the hypotheses as part of a sequential design process to develop the overall component. Thus, for example, costs of developing a new or improved business component are not eligible for the credit if the method of reaching the desired objective (the new or improved product characteristics) is readily discernible and applicable as of the beginning of the research activities, so that true experimentation in the scientific or laboratory sense would not have to be undertaken to develop, test, and choose among viable alternatives. On the other hand, the costs of experiments are eligible for the credit if the researchers are engaged in scientific experimentation. H.R. CONF. REP. NO. 841, 99th Cong., 2d Sess. at II-71 (1986).

If the requirements of section 41 are not met with respect to a product held for sale by T in its trade or business, but are met with respect to one or more elements thereof, the term "business component" means the most significant set of elements of such product with respect to which all requirements are met. Thus, the requirements are applied first at the level of the entire product held for sale by T in its trade or business. If all aspects of the requirements of section 41 are not met at that level, the test applies at the most significant subset of elements of the product. This "shrinking back" of the product is to continue until either a subset of elements of the product that satisfies the requirements is reached, or the most basic element

of the product is reached and such element fails to satisfy the test. H.R. CONF. REP. NO. 841, 99th Cong., 2d Sess. at II-72-73 (1986).

Insufficient information has been provided to make a determination as to which expenses associated with the design of the chip constitute qualified research.

To the extent the expenses do constitute qualified research, several activities are specifically excluded from the definition of qualified research, including research conducted after commercial production of the business component. I.R.C. § 41(d)(4)(A). Section 41(d)(4)(A) was added by the Tax Reform Act of 1986. With respect to the specifically provided excluded activities, the conference report states the following:

The conference agreement provides that activities with respect to a business component after the beginning of commercial production of the component cannot qualify as qualified research. Thus, no expenditures relating to a business component are eligible for the credit after the component has been developed to the point where it either meets the basic functional and economic requirements of the taxpayer for such component or is ready for commercial sale or use. For example, the credit is not available for such expenditures as the costs of preproduction planning for a finished business component, "tooling-up" for production, trial production runs, "trouble-shooting" involving detecting faults in production equipment or processes, accumulation of data relating to production processes, and the cost of "debugging" product flaws.

H.R. CONF. REP. NO. 841, 99th Cong., 2d Sess. at II-74-75 (1986).

CASE DEVELOPMENT, HAZARDS AND OTHER CONSIDERATIONS:

Expenses Incurred in Manufacture of Wafer and Mask

Of the 24 prototype wafers run per week, generally no more than 10 wafers are tested for each design change during the development process. To the extent of the extra wafers which are sold, because chips are tangible property of a character subject to the allowance for depreciation, such expenses are not supplies and therefore not eligible for the credit under section 41. It is unclear from the facts, however, whether the 10 wafers tested are also sold. To the extent any chip must be discarded, the chip is not property of a character subject to depreciation and would qualify as a supply for purposes of computing the research credit. I.R.C. § 41(2)(C).

In addition, Congress' purpose in enacting the credit was to encourage business firms to perform the research necessary to increase the innovative qualities and efficiency of the U.S. economy. S. REPT. NO. 313, 99th Cong. 2d Sess, p. 693, 694 (1986). As the 10 wafers were necessary for T to perform the research necessary to increase the innovative qualities of chips, they are consistent with Congress' purposes and may be considered a supply regardless of their character as a depreciable asset. [REDACTED]

Completion of Research for Purposes of Section 41

"First silicon" is the first set of silicon wafers produced for a new chip design. T performs limited functionality tests on the first silicon to begin to assess the extent to which the initial product and process design choices were successful. The results of these tests begin the process of determining the need for design changes. [REDACTED]

Three steps are used to measure whether the product meets T's overall function requirements. In product and process qualification, the new component is tested to determine if it meets certain standards regarding its ability to operate in specific environments and whether T's standards for expected product life are met. Yield, which measures the number of good die out of the total die per wafer, along with product characterization is a primary determinant of whether a new design meets T's basic functional and economic requirements.

When commercial production begins is a factual question. It is our opinion that, based on the facts provided, T has not begun commercial production until the prototype chips have met the function requirements. Our opinion is based on the fact that, prior to this time, the chip neither "meets the basic functional and economic requirements of the taxpayer for such component" nor "is ready for commercial sale or use."

The fact that T is able to sell the chips from the first silicon and subsequent test runs does not establish that the chip has met T's overall function requirements. In fact, the facts indicate the contrary. While T's engineers redesign the portions of the chip which did not work as originally conceptualized, T announces the availability of the chip and sells the chip in its various stages of revision. Sale of

such chips are made from the first silicon stage and continue until T determines that the chip is in the commercial production stage.

The fact that T can sell the prototype chips does not establish that the chip was ready for commercial sale or use. To the contrary, the price charged for the chip prior to commercial production is high and T could not sell such chips at commercial volumes at this higher price. Furthermore, there is no indication that T would obtain chips at each stage of the revision in excess of those required by the third-party wafer manufacturer or reasonably necessary to complete the redesign of the chip for the purpose of marketing the chips.

Finally, prior to the time the chip met T's function requirements and was placed in commercial production, testing had not been completed and no prototype of the chip T intended to design existed. Design changes are made throughout the development process in an attempt to increase the number of fully functional die per wafer. Design changes typically result in mask changes. The new wafers are then tested, the need for design changes identified, and the process begins again. Thus, the development process involves testing, circuit redesign, mask change notice, purchase of new wafers fabricated pursuant to the mask change notice, and the testing of the newly fabricated wafers. This process continues until the yield that establishes commercial manufacturability is reached. Until such criteria has been met, T has not completed the development of the intended chip and does not begin construction of additional copies, or commercial production.



Please call if you have any further questions.

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