

Progress Report on NECTEC's Microelectronics Project

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ABSTRACT -- As a national center, NECTEC's road map in the area of microelectronics is to start from IC/VLSI design, wafer fabrication and then to expand into the areas of flat panel display devices, sensors, optoelectronics, and so on. The mission is to activate the rise of microelectronics industry in Thailand. After nearly ten years, however, the progress has not been significant. Main reason is the lack of strategy and commitment in the national policy-making level. Most of the activities are bottom-up oriented, and not well-enough supported. Under this situation, NECTEC is working hard to promote IC/VLSI design, and to realize Thailand's first wafer fabrication line. In this report NECTEC's microelectronics related activities are summarized.

1. Introduction

NECTEC has started its activity on micro-electronics in 1989 by joining the ASEAN - Australia cooperation project. Some VLSI have been designed in-house and sent for fabrication in Australia during the program.

In 1994, NECTEC has provided the software tools for VLSI design to about 10 universities in Thailand to support their educational program and activity on VLSI design. This has contributed to the gradual expansion of the design activities in Thailand and after several years, there are already some IC design companies starting their business.

In the same year, NECTEC signed an agreement with IMEC (Interuniversity Microelectronics Center) of Belgium under the agreement of cooperation in microelectronic sector between Thailand and Belgium governments. Under this agreement, NECTEC will send engineers and technicians for 50 man-months to IMEC for training in process technology and facilities management focusing, practically at 0.5 micron CMOS technology. IMEC will transfer basic process technology and provide necessary consultancy where Belgium government will subsidize the cost on IMEC's side. This agreement will end by 31 August 2000.

In 1995, the Cabinet has approved the proposal of NECTEC to establish the Thai Microelectronics Center (TMEC). The plan is to build a wafer fabrication line for CMOS process technology below 1 micron with the capacity of 500 six-inches wafers/month. The original objectives and goals of this project have been summarized in Ref.1. Under the proposal, the government will support 600 million Baht in 3 years for establishing the TMEC center and a private company, Alphatec Group, will donate another 300 million Baht for the project. Because they are planning to start wafer fabrication business in Thailand and need support in the area of human resource development.

2. Current Status and future plan

At present, NECTEC's microelectronics related activities can be summarized as follows.

2.1 TMEC Project

In 1997, NECTEC has started the construction of the TMEC building in the Alpha-technopolis Industrial Park at Chacherngsao province. Cleanroom, equipped with necessary facilities to support CMOS 0.5 micron technology, of class 100 (300 m²) and class 1000 (700 m²) are the main features. Originally the work was planned to be finished by March 1998, however due to the contractor financial problem after the economic crisis in 1997, the progress of construction had become very slow and out of schedule. Extensions of the contract have been made several times due to government measures to help construction industry from the economic crisis. This gave further delay to the construction and at present the contract is extended until 31 January 2000.

Figure 1 and 2 show the progress at the construction site as of August 1999. The amount of accomplished work is about 20% of the total.



Fig. 1 TMEC Construction site (August 99)



Fig. 2 TMEC Construction site (August 99)

Figure 3 shows the design drawing of the TMEC building.



Fig. 3 TMEC Building

For the process and metrology equipment, 10 items have been purchased. About 25 more are necessary.

For the TMEC Project as a whole, the bad economic situation from 1996 and the Baht crisis in 1997 have raised serious problems. Firstly, it was not possible for the Alphatec Group to donate the 300 million Baht to the project as plan. Secondly, with the only 600 million Baht from the government and the depreciation of the Baht after mid 1997, it is not possible to complete the project without additional financial support. From 1998 to mid 1999, a lot of effort has been spent to find way-out. Eventually the Project has been re-studied and the revised proposal of the TMEC Project has been approved by the NSTDA Board in August 1999. Now it is being submitted to the Minister of Science Technology and Environment to ask for the Cabinet approval. Only after that that NECTEC will have necessary funding to accomplish the plan of this project.

In the revised proposal, the main philosophy of the project has been changed from to be the center to mainly support human resource development for the wafer fabrication industry (process engineer), to the center to activate the rise of IC/VLSI design industry in Thailand (design engineer). This is considered more strategically appropriate since Thailand has a wide base of IC/VLSI design education network in more than 10 major universities with more are participating. A large pool of new designers can be expected to contribute to the rise of IC/VLSI design industry in Thailand in near future.

For the cooperation with IMEC, NECTEC has accomplished sending engineers for 50 man-months training to IMEC by

August 1999. The training covered almost all aspects of wafer fabrication (process technology, process integration, design technology, fab management, and facilities design and maintenance, QA and safety, etc.) Under the agreement, IMEC will send experts to help commissioning TMEC's cleanroom and advising process start-up. Collaboration beyond the end of present agreement is under consideration.

2.2 MPC (5 um) Program with ERC/KMITL

Beginning in 1996, NECTEC has started a Multi Project Chip (MPC) program with Electronic Research Center (ERC) of King Mongkut's Institute of Technology Ladkrabang (KMITL) to upgrade the microelectronics facilities of ERC from 20 micron process to 5 micron CMOS process. The main aim is to make the facilities up-to-date and ready as a center of excellence for providing multi project chip fabrication service for universities over Thailand. A new cleanroom of class 1000 (30 m²) and class 10,000 (111 m²) has been built. LPCVD, ion implanter, etcher, furnace have been newly purchased or upgraded. After a long series of effort, it is planed to open its service by March 2000. Under this scheme, NECTEC and ERC/KMITL will arrange a MPC (Multi Project Chip) fabrication service for IC/VLSI designers.



Fig. 4 ERC/KMITL Cleanroom

2.3 IC/VLSI design and Promotion

As mentioned earlier, this activity is considered the most important at present because it is the mission to explore Thailand's new capability in IC/VLSI design area. The facts that it is not highly capital intensive (compare with wafer fabrication), the technology is still growing, the worldwide shortage of VLSI designers, and the chance of gaining business opportunity worldwide are convincing to most people. The success of this activity will be crucial for the rise of microelectronics industry in Thailand.

In-house design projects: At present , there are several in-house design projects running. First is a project to design the 8051 microcontroller compatible chip with higher performance. Another is the project to design a GPS chip (Global Positioning System).

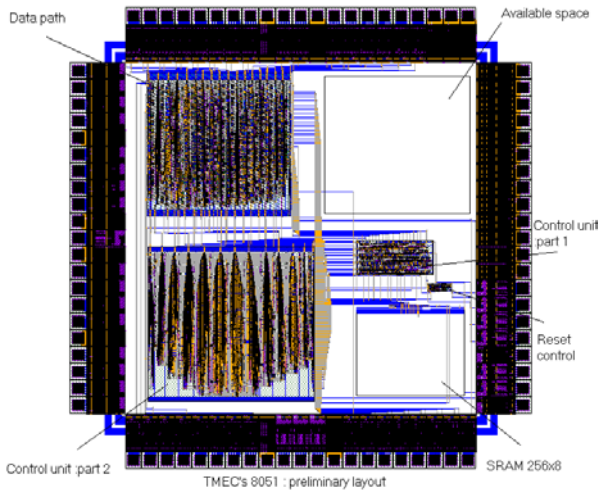


Fig. 5 TMEC's 8051 layout design

Promotion of IC/VLSI design To strengthen the design community, NECTEC has initiated several new activities.

1. **Establishing of Microelectronics Forum** In January 1999, NECTEC has initiated the microelectronics community in Thailand which comprises of universities, IC packaging industries, hard disk drive industries, system houses, and design houses to setup the Microelectronics Forum. The main objective is to utilize the expertise and resources of each party to organize training for industrial work force to help upgrading microelectronics industries in Thailand towards higher value added and upstream industry. The Forum is also aiming to cooperate in consolidation of appropriate policy/strategy and make suggestion to the Thai government.

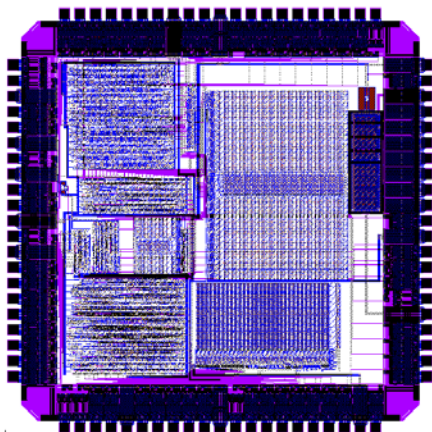


Fig. 6 MTT's Thaitum-2 chip layout design

2. **Establishing of IC Design Network** Also in January 1999, NECTEC has set up the IC Design Network. It is the network of people doing design in Thailand with members of about 40 at present. The main aims are to cooperate in both development of new IC/VLSI designers and sharing of expertise and IP resources in real design projects.

3. **Supporting private design houses:** Although still a few, there are already several design companies in Thailand. NECTEC is trying its best to support these companies. As an example, MTT (Microelectronic Technologies Thailand) is collaborating with NECTEC in submitting their designs for fabrication through IMEC of Belgium under EuroPractice Program. Figure 4 is the layout design of the "ThaiTum2" chip (microcontroller) of MTT. The company is also offering commercial service for layout design to outside customers.
4. **Development of AIT master program** AIT (Asian Institute of Technology) is planning to start its master degree in microelectronics from May 2000 academic year. NECTEC strongly involves in the establishment of this program and will actively support the program, providing faculties for some courses and also facilities for students' projects.

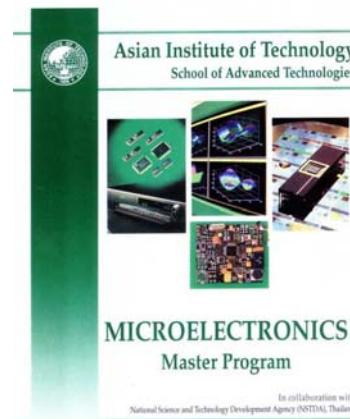


Fig. 7 AIT's microelectronics program

5. **IC Design Contest 2000** As a result of the 3rd IC Design Network meeting held on 31 August 1999, a committee has been setup to run the Thailand first IC design contest to enhance the public knowledge and interest in IC/VLSI design. For this first "IC Design Contest 2000", specifications of the target chips, one analog and one digital, will be given and the chance is open to all designers. About 50 challengers are expected and the designs of the winners will be sent for real fabrication.

3. Summary

NECTEC as a national center is doing its best to promote microelectronics in Thailand. Activities span from academic cooperation on human resource development to promoting and supporting IC designers both in universities and private sectors. Without strong commitment and sufficient supports comparable to other countries, real strength and success of Thailand in microelectronics is not foreseeable.

4. Acknowledgment

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