The EUROPRACTICE MPC Service

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Abstract - IMEC has been involved in MPC services for universities and industry since 1984. In the beginning these services have been set up to support the local educational programme. Lateron in 1989, IMEC was coordinator of the European wide MPC services in the EC funded project EUROCHIP. Today since October 1995, IMEC has been coordinator of the IC Manufacturing Service in the EC funded project EUROPRACTICE.

I. INTRODUCTION

Multiproject Services are available for about 10 to 15 years now. The MOSIS service in the US is probably the most widely known service, but the more recent European initiatives EUROCHIP and EUROPRACTICE do cover a much broader service. During the 6-years period of the EUROCHIP project (from 1989 until 1995), a total service, including advanced training courses, CAD support and MPC service was set up. At the end of this project, about 400 European universities used these services and more than 2,000 ASIC designs have been prototyped.
In the current EUROPRACTICE (EC funded) project, the service has even been extended and includes also Multichip Modules (MCM) and Microsystems.
This paper will discuss the EUROPRACTICE MPC service in more detail.

II. THE EUROPRACTICE PROJECT

A new 18 MECU ESPRIT initiative in the field of microelectronics has been launched by the European Commission (EC) : EUROPRACTICE (PRomoting Access to Components, subsystems and Microsystems Technologies for Industrial Competitiveness in Europe).
EUROPRACTICE will concentrate primarily on three microelectronics-based technologies : Application Specific Integrated Circuits (ASICs), Multi-Chip Modules (MCMs) and Microsystems.
EUROPRACTICE services will be available to both industrial and academic users although the main emphasis will be on industry and Small and Medium sized Enterprises (SMEs). Currently, many European SMEs could benefit from the exploitation of ASICs, MCMs and Microsystems in their products though many are unaware of the commercial benefits offered by the use of these technologies. EUROPRACTICE aims to provide the impetus and technical support to encourage these SMEs to develop ASICs, MCMs and Microsystems for use in their products.
EUROPRACTICE will achieve this by establishing Basic Services that will offer users a cost-effective and flexible means of accessing ASICs, MCMs and Microsystems technologies through the provision of consultancy, training, software tools, design support and prototype and low-volume production runs.
EUROPRACTICE services for academic users will build upon the success of the recent EC-funded EUROCHIP project in offering low-cost access to CAD, ASICs and training. It is anticipated that in excess of 400 universities across Europe will participate in EUROPRACTICE and it is hoped that by enhancing their ability to train young engineers in microelectronics technologies, EUROPRACTICE will make further long-term contribution to Europe's industrial competitiveness.

III. MPC OR LOW-COST ASICS

Although off-the-shelf microelectronics components are very cheap today and available in great variety, the cost of developing a new ASIC (Application Specific Integrated Circuit) for dedicated niche applications in a small market-share is very high. This is largely due to the high NRE (non-recurring engineering) costs such as design, manufacturing and test development costs. When a new product is formulated for a small market, although ASICs may provide the best technical solution, the production cost for the ASICs will be high, thus preventing industry, in particular SMEs who produce low volume products, from using ASICs.
However, the high NRE production cost, especially for ASIC prototyping, can be reduced by combining designs from different customers onto one wafer. This technique, known as a Multi Project Chip (MPC), allows the high cost to be shared among a number of customers.

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Using the MPC principle, circuits from different customers will be grouped together until the maximum possible chip size defined by the reticle size is reached. This 'super chip' is then fabricated on a small prototype batch. The number of wafers is minimised to reduce the costs further. The wafers are then divided in such a way that the individual chips belonging to each customer can be delivered either as dies or as encapsulated prototypes. Because of the small wafer batch, a limited number of ASIC prototypes, typically 10 or 20, are returned to the customer for evaluation. In the standard operation, all prototype chips are untested. However, since prototypes will only be taken from wafers that are fully qualified according to foundry specifications, it is likely that the majority of the delivered chips will function correctly.

First-time-right silicon is very important for the ASIC designers and, in order to achieve this, extensive DRC (Design Rule Checking) and ERC (Electrical Rule Checking) are performed on the submitted designs. The wide range of packages offered ensures that customers have full flexibility in encapsulation. Other services available include Layout-versus-Schematic check, plastic packaging and prototype testing.

IV. The EUROPRACTICE IC MANUFACTURING SERVICE

Four MPC Service Centers are operating the EUROPRACTICE IC Manufacturing Service namely IMEC (Belgium), Nordic VLSI (Norway), Fraunhofer-Institut FhG/IIS (Germany) and DELTA (Denmark).

IMEC coordinates the overall IC Manufacturing Service and represents the service in the global EUROPRACTICE project and has responsibility for the administrative and technical support of the universities concerning the distribution of foundry documents and design kits, NDAs, approval of EC-subsidy for the prototyping of educational designs, etc.

FhG/IIS, IMEC, Nordic VLSI and DELTA act as MPC Service Centers and organise MPC runs and small volume production in several technologies. Customers are able to select the MPC Service Center of their choice for design submission and checking of DRC and ERC errors. This MPC Service Center will then pass the approved design to that center that organises the MPC run. In this way, the customers can keep their interface with a single MPC Service Center for design submission, checking, etc.

The EUROPRACTICE MPC services are not restricted to Europe, but are open to all universities and industries from all countries of the world provided that these countries are not restricted by the existing export regulations

V. TECHNOLOGIES

The technologies that are supported in the EUROPRACTICE project have been selected following the general evolution in the microelectronics and the needs of the customers, both academia and industry. The EUROPRACTICE MPC Service Centers have been offering MPC services in the frame of national schemes since the early 80s and more recently through specific ESPRIT supported projects like EUROCHIP. Their experience shows that there is still a major need for CMOS technologies with the emphasis on digital designs but with an increasing interest in mixed analog-digital technologies. In addition there is also a growing need for BiCMOS and GaAs technologies.

The selection of foundries that can offer those technologies is mainly based on 4 criteria : (i) industrial qualified process lines are chosen in order to guarantee a high level of quality (high and constant yield); (ii) fast turn around; (iii) availability of foundry supported design kits and (iv) flexibility in MPC run fabrication concerning scheduling and number of wafers.

Due to the experience with national and European MPC schemes European foundries have been selected so far, but there is no restriction on the selection of foundries from the US, Japan or the Far-East.

The current technologies that are supported by the EUROPRACTICE partners are :

- technologies for digital design
  - Alcatel Mietec 0.7µ CMOS (double metal)
  - Alcatel Mietec 0.5µ CMOS (triple metal)
  - ATMEL-ES2 1.0µ CMOS (double metal)
  - ATMEL-ES2 0.7µ CMOS (double metal)
  - AMS 0.6µ CMOS (double metal)
  - Thesys 0.8µ CMOS QGATE gate arrays
- technologies for digital, analog and mixed analog-digital design
  - Alcatel Mietec 2µ CMOS (double poly, double metal)
  - Alcatel Mietec 0.7µ CMOS (poly-dif. capacitors, double metal)
  - Alcatel Mietec 0.5µ CMOS (double poly, triple metal)
  - AMS 1.2µ CMOS (double poly, double metal)
  - AMS 0.8µ CMOS (double poly, double metal)
- technologies for BiCMOS design
  - Alcatel Mietec 2µ HBIMOS for high voltage (100 volt) applications
  - AMS 1.2µ BiCMOS for high frequency applications (double poly, double metal)
  - AMS 0.8µ BiCMOS for high frequency applications (double poly, double metal)
- technologies for GaAs design
  - GEC-Marconi F20 MESFET GaAs for MMIC applications

    - GEC-Marconi H40 HEMT GaAs for MMIC applications
- ASIC bipolar arrays (low complexity, 40 volt)
- radiation hard BiCMOS technology (10 Mrad)
    - TEMIC D-MILL 0.8µ BiCMOS technology

The offering of most advanced technologies for prototyping is mandatory to ensure competitive and still up-to-date fabrication possibilities at the time that prototypes go into volume fabrication (normally one year after prototyping start).

VI. Design kits

It has been pointed out before that the availability of foundry supported design kits is one of the major criteria for process selection. Design kits are the vital link for the designer between technology and CAD design tool. The design kit contains all the necessary technology and cell library information and configures the CAD tool for a specific technology. For education and research, design kits developed by universities and research laboratories for less used CAD tools may be sufficient for prototyping and idea evaluation because guarantee and quality is of less importance. But for industrial customers it is mandatory that foundry supported and qualified design kits are available in order to guarantee a qualified route from prototype to volume production. Most foundries concentrate design kit development and updates on their newest technologies. That is also one of the reasons that the newest and most advanced technologies have to be added to the MPC portfolio. Design kits and technology related documentation are available from IMEC under non-disclosure agreement (NDA). Design kits are available for the most popular CAD tools such as Cadence, Mentor Graphics, Synopsys, Tanner, Viewlogic, etc. These design kits are distributed on CD-ROM in encrypted format. Keys to decrypt and install the design kits are delivered by IMEC after NDA.

VII. Small volume fabrication

Industry needs volume fabrication but in many cases especially research laboratories and smaller enterprises need small volumes. Foundries are organised to handle high volumes but not small volumes due to the large overhead.

In order to offer attractive low cost ASICs in small volume to the industry, the EUROPRACTICE partners and the foundries have worked out several solutions. The foundry manufactures small (just enough) but qualified wafer lots (number of wafers ranging from 2 to a few hundreds). The EUROPRACTICE partners then subcontract testing and packaging to qualified houses. This path is now well-proven and many ASICs have been successfully fabricated in quantities ranging from 100 to 10,000.

VIII. Available information

It is not possible to detail here the extensive information available, such as technology specifications, price list, NDA forms, etc. All this information is available on the World Wide Web and in continuously updated (http://www.imec.be/europractice/europractice.html).
Customers are informed on all major updates by e-mail. A newsletter "ASICs newsline" is regularly distributed with all new information. Designers wishing to receive e-mail information or the newsletter should simply send a request to IMEC (mpc@imec.be).

IX. Conclusion

In the frame of the EUROPRACTICE project, IMEC offers an industrially oriented low cost service for ASIC prototyping and small volume fabrication in the most popular CMOS, BiCMOS, bipolar and GaAs technologies. Experience is based on more than 10-years operation.

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