

Report from Yole Développement

“PowerD 06”: Advanced Technologies and Related Markets for Power Devices

15% of power devices will use new materials (SOI, Thin wafers, SiC, GaN ...) in the next 5 years...

Price: Euro 1,990
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In the microelectronics world, the power devices industry is very specific, as there are few standards and represents some percents of the mainstream semiconductor business (about 10%). However, this industry is also characterized by a high level of innovations with **new advanced technologies** like **deep etching**, the use of **SOI, SiC, GaN** or **thin wafers** to answer power devices technical challenges.

This report gives a complete analysis of the markets and new technical trends for the power devices industry.

Power devices have numerous applications. The most common are industry, automotive, traction motor, high voltage direct current, home applications and wind power.

The power devices market was about \$16 billion in 2003 and \$20 billion in 2004 (fig. 1).

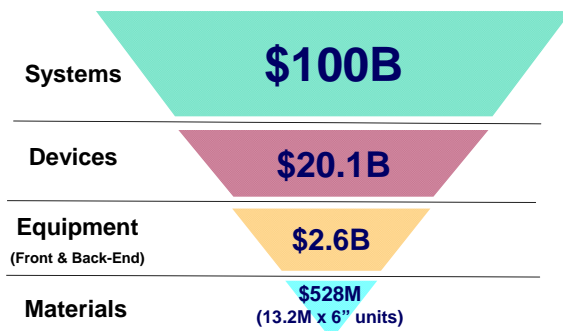


Figure 1: 2004 Power Devices foodchain value

In 2007, Yole forecasts that the market will grow to \$25 billion. Over it, SiC power devices was only \$12M in 2004 but is forecasted to reach more than \$100M by 2009. IPMs are 45 to 50% of the total market and the most common discretés are power MOSFETs (35% of the discretés market) and BJT's (27% of the total discretés market).

In 2004, the total power devices wafer consumption was 13.2 millions x 6" wafers (4" and 6" wafers are mostly used and the wafer consumption for power devices is 7.1% of total IC wafer consumption). As a general rule, the power devices industry is about 7 to 10% of the total semiconductor industry. SOI wafers will represent about 500,000 units by 2010 (Fig. 2).

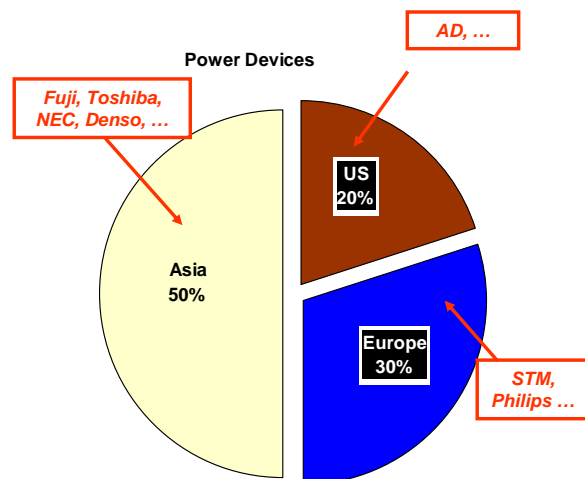


Figure 2: Geographical distribution of SOI wafers consumption for Power Devices.

The report is presenting the current and future technical solutions to improve power devices. The key challenges are:

- Lower $R_{ds(on)}$: the global switch resistance in the on state (to have low heating, low losses)
- Lower cell size: shrinking the chip area reduces the chip cost but power dissipation per unit area becomes then an issue
- To add protecting features: high operating temperature, latch up free, very high voltage applications, ElectroStatic Discharge (ESD) protection are requested for automotive applications
- To build robust devices

In terms of new technologies, these challenges are driving new development in deep reactive ionic etching (for isolation and new super junction structures), the use of ultra thin wafers (100µm already entering in production and 85 µm emerging), SiC, GaN and SOI wafers (Including partial SOI wafers that could

be used by 2010). The report provides a complete and in-depth analysis of these emerging technologies (Fig. 3), forecasting their impacts on the related material and equipment market.

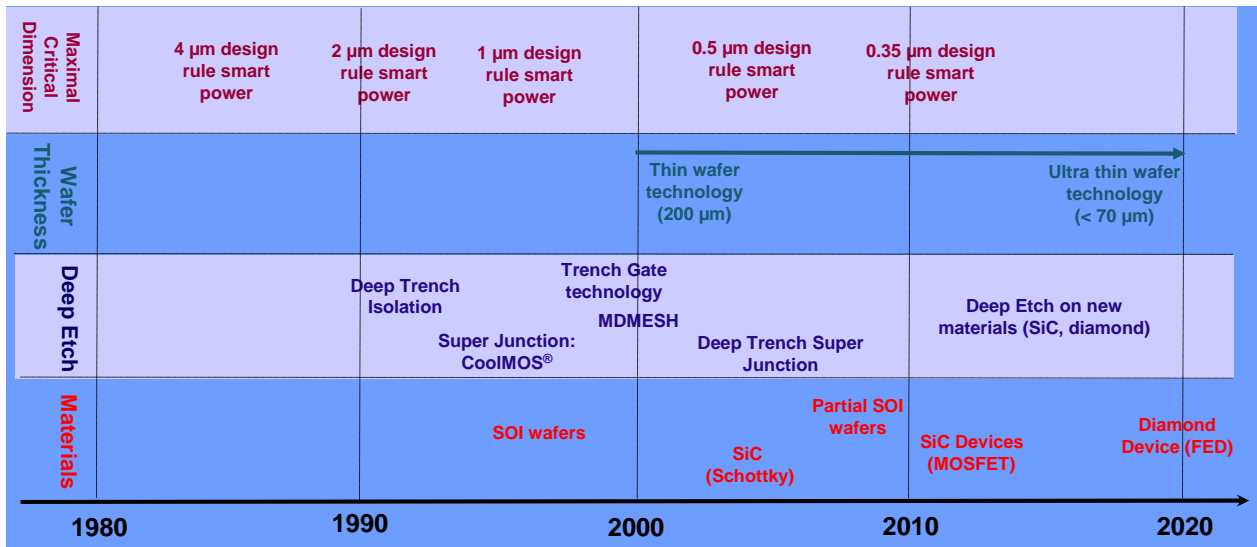


Figure 3: Example of roadmap for advanced technologies and manufacturing parameters used in Power Devices field

Benefits of the report for equipment and materials manufacturers:

- Analysis of the structure of the power devices industry and evolution of the industrial food chain
- Calculation of wafer volumes to be produced including new materials implementation on different market segments
- Description of the new processes and related equipment and materials markets

Benefits of the report for power devices manufacturers:

- Analysis of the current applications and detailed analysis of the future businesses
- Analysis of the competition
- New developments and future trends
- Volumes and prices forecasts
- Alternative solutions for trench MOSFET
- IPM market description and forecasts
- SiC & GaN electronics opportunities
- SOI technology analysis

Content of Company Profiles:

Company Name

- Address
- Telephone, Fax, Web site, Email
- Key managers and/or contacts
- Company Overview
- Market, customers and products
- Agreements and Alliances
- Financial data (if available)
- Main Technologies

Description of the facility

- Manufacturing Facilities area (m²)
- Activity of the plant and nature of the plant
- Total Investment
- Forecasted investment
- Type of material and Wafer size (mm)
- Clean room size (m²) and class
- Production capacity (wpw)
- Staff involved in production

CONTENT OF THE REPORT

“PowerD 06”: Advanced Technologies and Related Markets for Power Devices

Report name: PowerD 06
Publication date: January 2006
Number of pages: 150+ slides (PowerPoint® presentation) plus 67 profiles of Power Devices players worldwide (Excel® table format)
Price: Euro 1,990

About Yole Développement

Yole Développement is a market research and strategy consulting company, specialized in the MEMS, compound semiconductors, power devices and instrumentation for biology markets. Yole Développement offers different kind of services:

- *Custom market research analysis*
- *Technology analysis*
- *Business development services*
- *Specific market reports.*

For more than 5 years, Yole Développement is a unique player in the analysis of the Power Semiconductors market: our 18 consultants are working worldwide with the key industrial companies, R&D institutes and investors in order to help them to understand the markets and technology trends in these fields.

Yole Développement is taking into account the complete value chain in its analysis, including materials and capital equipment business, device manufacturers and system manufacturers, users of the devices.

Content of the report

Executive summary

Synthesis

A vision of 2015 PD market...

Introduction

1 – Market data

- Targeted applications by devices type
- 2003-2009 Power devices market forecast
- The global power devices market:
- IPM will represent more than 50% by 2008
- Comparison with mainstream SC market
- Focus on Discretes market, IPM
- Ranking of power devices manufacturers
- ...

2 - Power Devices: from a material point of view

2003-2009 wafers consumption (6” equ. wafers units)

Wafers diameters

SOI wafers for power devices

What kind of applications is targeting SOI ?

What kind of components is targeting SOI ?

The Membrane Power Device...

Thin Wafers

Thin wafers issues

Thin wafers used for Non-Punch-Through (NPT)

IGBT structure

Thin wafers process example: Fraunhofer Institute...

Silicon Carbide

SiC Power electronics market segmentation

SiC Power electronics Applications roadmap

The switching

SiC power devices: chips size and power density

SiC Schottky diodes: The most mature SiC device

SiC Schottky diodes Devices specs roadmap

Schottky diodes: 2003-2009 SiC wafers consumption

...

3 - Power Devices: From a process point of view:

New emerging technologies

- **Lithography & CD evolution**
- **Deep Etching for Deep Trench Isolation & Trench Gate**
- **Super Junction Structures**

4- Description of main discrete devices

Power Devices Overview

Unipolar and bipolar power devices

Power Switches Overview

Si Power Devices Capabilities

Power devices applications vs. characteristics

Power MOSFET, BJT (Bipolar Junction Transistors)

IGBTs (Insulated gate Bipolar Transistor), Thyristors:

SRC, TRIAC, GTO, MTO..., Rectifiers

Company profiles included in the report:

Fairchild, Texas Instruments, International Rectifier, Renesas, Toshiba, National Semi, On Semi, Infineon, Vishay, Matsushita, Mitsubishi, STM, NEC, Philips, Rohm, Freescale, Sanyo, Fuji, Ricoh, Ixys, Fujitsu...

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