Investigating the Global Trend of Semiconductor Industry by Reviewing the Digital-Analog Converters

Bing Han, Akira Matsuzawa
Tokyo Institute of Technology, Japan
Jian-Guo Ma
Tianjin University, China

2010/12/15
OUTLINE

• Background
• DACs and semiconductor market
• The trends of DACs and semiconductor market
• The globalization of the semiconductor industry
• Summary
Background

★ The regional distribution of DAC papers (Jan. 2009-May 2010)
The source of data

Papers and also technical and trade reports
DACs and semiconductor market

- communications, consumer, industrial and instrument, medical electronics and computer
- DACs reflect the market requirements
The trends of DACs and semiconductor market

The application and the regional distribution of the research on DACs and of the semiconductor market
The application segment of DAC papers

- The performances of DACs change with product requirements

The graph shows the application segments of DAC papers over different years, categorized into communications, consumer, instrumentation, medical electronics, and computer. The performances are grouped into different speed ranges and bit resolutions.

- **1MS/s, 10 to 15bits** for consumer, instrumentation, and computer
- **100KSPS to 100MSPS** for telecommunications and medical electronics
- **1GS/s, 5 to 15bits, a dozen mW** for communication, consumer, and medical electronics
The proportion of semiconductor products applications

Similar to the research on DAC, the development of semiconductor products in different applications and in different periods is changing according to the market demands

- From the 80's to the 90's
  - Computer-related products occupied more than half of semiconductor market sales
  - Communication and consumer products occupied 35% in 1990
  - Computer-related products occupied 35% in 1990

- From the 90's to 21 century
  - The share of communication products occupied 15% of semiconductor market sales in 1995
  - The share of consumer products occupied 23% of semiconductor market sales in 1995

- 21 century
  - The share of communication products occupied 20% of semiconductor market sales in 2009. Especially mobile phones shared 16%
  - The share of consumer products occupied 27% of semiconductor market sales in 2009
The regional distribution to the research on DAC

- The globalization trend of The research on DAC is confirming, with America, Europe, Asia-Pacific and Japan gradually acting as the core.
The regional distribution of the semiconductor market

- The semiconductor market rising spiral
- The globalization trend of the semiconductor market is confirming, with Asia-Pacific acting as the core

Data source: WSTS, Graphics: Han Bing

EDSSC 2010 15-17 December 2010 Hong Kong, China
Figure of merit of DACs

- The smaller the better

\[ FOM = \frac{P_{\text{dis}}}{2^{\text{bits}}} \times f_{\text{sample}} \]

12 bits, 500 MSPS, 2.6mW [14]
15 bits, 100 MSPS, 10mW [13]
14 bits, 100 MSPS, 20mW [11]
12 bits, 2.9 GSPS, 188mW [10]
14 bits, 105 MSPS, 9mW [12]
Some information about Technology and market

1. Technology
   - From March to June in 2010, semiconductor products using 60nm or smaller process accounted for 38% of all. The dimensions of semiconductor process tend to be smaller in size.
   - That super-fast (such as 32GSPS), low power consumption (150uW), smaller area (0.0066mm2), high resolution (24bit), low power supply(0.5V) DACs had been designed.

2. Market
   - The popular products in the near future will be mainly audio-visual entertainment products, mobile wireless applications, electrical, water and power metering devices, medical electronics and automotive industrial applications products, enterprises network and other mature terminals markets etc.
The countries distribution to the research on DAC

2010/12/15

EDSSC 2010 15-17 December 2010 Hong Kong, China
The globalization of the semiconductor industry

(Technology and market promote the globalization of the semiconductor industry)
The trend of the research on DAC

- There is a fluctuation cycle almost every five years (obviously after 1985)
  — Oversupply, Global recession and technology development could be the reason
The trend of worldwide semiconductor market

- There is a fluctuation cycle almost every five years
  - Oversupply, Global recession and technology development could be the reason

Data source: WSTS, Graphics: Bing Han

EDSSC 2010 15-17 December 2010 Hong Kong, China
The trend of DAC papers and of worldwide semiconductor market
The quantity of DAC papers over year

- The research on DAC rising spiral
- The research on DAC affected by the market demands
Region share of DAC papers

- From the 60’s to the 80’s, Americas and Europe
- In the 80’s, Japan consumer and DRAM
- From the 80’s to the 90’s, Asia-Pacific and Japan, China, Taiwan, South Korea, Singapore and India
- From the 90’s, Asia-Pacific
Region share of semiconductor market

- In the 80’s, Japan, consumer and DRAM
- In 1983, Korea’s Samsung DRAM
- In 1987, Taiwan’s TSMC was established, foundry businesses
- From the 90’s, Asia-Pacific, China, Taiwan, South Korea, Singapore, and India
Region share of DAC papers and of semiconductor market in Asia-Pacific

- Region share of DAC papers in Asia-Pacific
- Region share of semiconductor market in Asia-Pacific

Year

2010/12/15

EDSSC 2010 15-17 December 2010 Hong Kong, China
Summary

1. Statistical analysis of DAC papers
   - The performances of DACs change with product requirements
   - The research and development status of DAC confirm to the globalization trend of semiconductor technology and America, Europe, Asia-Pacific and Japan is gradually acting as the core

2. Semiconductor market analysis
   - The semiconductor industry is developed by the constantly emerging of new applications
   - The center of the global semiconductor market has changed from advanced countries to emerging countries

3. The globalization of the semiconductor industry
   - Technology and market promote the globalization of the semiconductor industry
   - The future semiconductor industry will no longer simply focus on the production line construction and the market sales. The design will occupy an increasing share
Thank you for your attention