

Integrated Circuit Economics

2011 Edition

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IC *KNOWLEDGE LLC*

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1.2. About IC Knowledge LLC

IC Knowledge LLC was founded in the year 2000 by a group of wafer fabrication technologists and management specialists. IC Knowledge LLC is dedicated to offering the finest training and reference materials available to the semiconductor industry.

1.3. IC Knowledge LLC products

- Integrated Circuit Cost and Price Model - a Microsoft Excel based cost model that uses dropdown menu selections to generate product costs and prices for most low power silicon based integrated circuit products.
- Discrete and Power Products Cost and Price Model - a Microsoft Excel based cost model that uses dropdown menu selections to generate product costs and prices for most discrete and power silicon based integrated circuit products.
- MEMS Cost Model - a Microsoft Excel based cost model that uses dropdown menu selections to generate product costs for most MEMS products.
- Strategic Cost Model - a Microsoft Excel based cost model that implements the 2010 ITRS from 2009 to 2024.
- Semiconductor Silicon Demand Forecast - a Microsoft Excel based forecast model of silicon demand.
- 300mm and 450mm Equipment Forecast - a Microsoft Excel based forecast of 300mm and 450mm equipment based on the 2010 ITRS.

- Integrated Circuit Economics - this report.
- Integrated Circuit Packaging - a report covering the packaging market, packaging technology, test, packaging technology trends, packaging foundry selection and pricing.
- 300mm and 450mm Watch - a Microsoft Excel based database of 300mm and 450mm fabs and companion analysis.

1.4. Disclaimer

We believe the information presented in this publication to be accurate and representative of general integrated circuit industry practices. Much of the information in this report is compiled from technical journals and other secondary sources. IC Knowledge LLC does not warranty the accuracy of the information presented in this report in any way. It is up to the user to determine whether the information presented is applicable to the situation the user is interested in.

1.5. Report outline

This report is broken up into thirteen chapters.

1. Welcome.
2. IC market status and trends - a general look at the IC market and market trends.
3. Capital and materials spending - an analysis of capital and materials spending and spending trends.
4. Economics trends - a high level analysis of IC economics.
5. 300mm and 450mm - a discussion of the impact of 300mm and 450mm wafer sizes on the industry.
6. Foundries - the impact and future of foundries.
7. Design - the impact of design complexity and cost.
8. Integrated circuit manufacturing overview - an overview of IC manufacturing and facility requirements.
9. Wafer fabrication costs - a detailed look at the costs of wafer fabrication.
10. Test and packaging costs - a detailed review of the costs to test and package integrated circuits.
11. Die yield and product costs - how to calculate die yield and die and product costs from the information presented in the previous two sections.
12. Cycle time and utilization - wafer fabrication facility utilization is one of the most important factors in determining costs, this section discusses factory management trade-offs.
13. Technology trends - trends in IC technology and a brief history of the IC.

1.6. What this report is not

This report is meant to give the reader an understanding of integrated circuit manufacturing costs and broad economic issues.

- We discuss general market trends, but this is not a market research firm and we are not in the business of forecasting the market. For market research and forecasts we recommend IC Insights at www.icinsights.com.
- This report is not intended to serve as a cookbook for calculating IC costs. To calculate costs for specific ICs, we recommend our IC Cost and Price Model.

1.7. A word about technology focus

For many years the overall driver of IC technology was DRAMs, then microprocessors displaced DRAMs in many areas and more recently NAND Flash has become a driver, although DRAMs still lead in areas such as high-k capacitor structures. For the purposes of technology analysis in this report, we discuss microprocessors, NAND Flash and DRAMs.

1.8. Acknowledgements

We would like to thank IC Insights for permission to reprint several tables from the 2011 edition of the McClean report. As we mentioned in the previous section we are not a market research firm - they are, and a good one. We strongly recommend the McClean report to anyone interested in understanding the semiconductor market in greater detail than presented here. We would also like to thank Linx Consulting, another company we strongly recommend for providing data for the section on Semiconductor Materials.