

A Semiconductor Packaging Forecast

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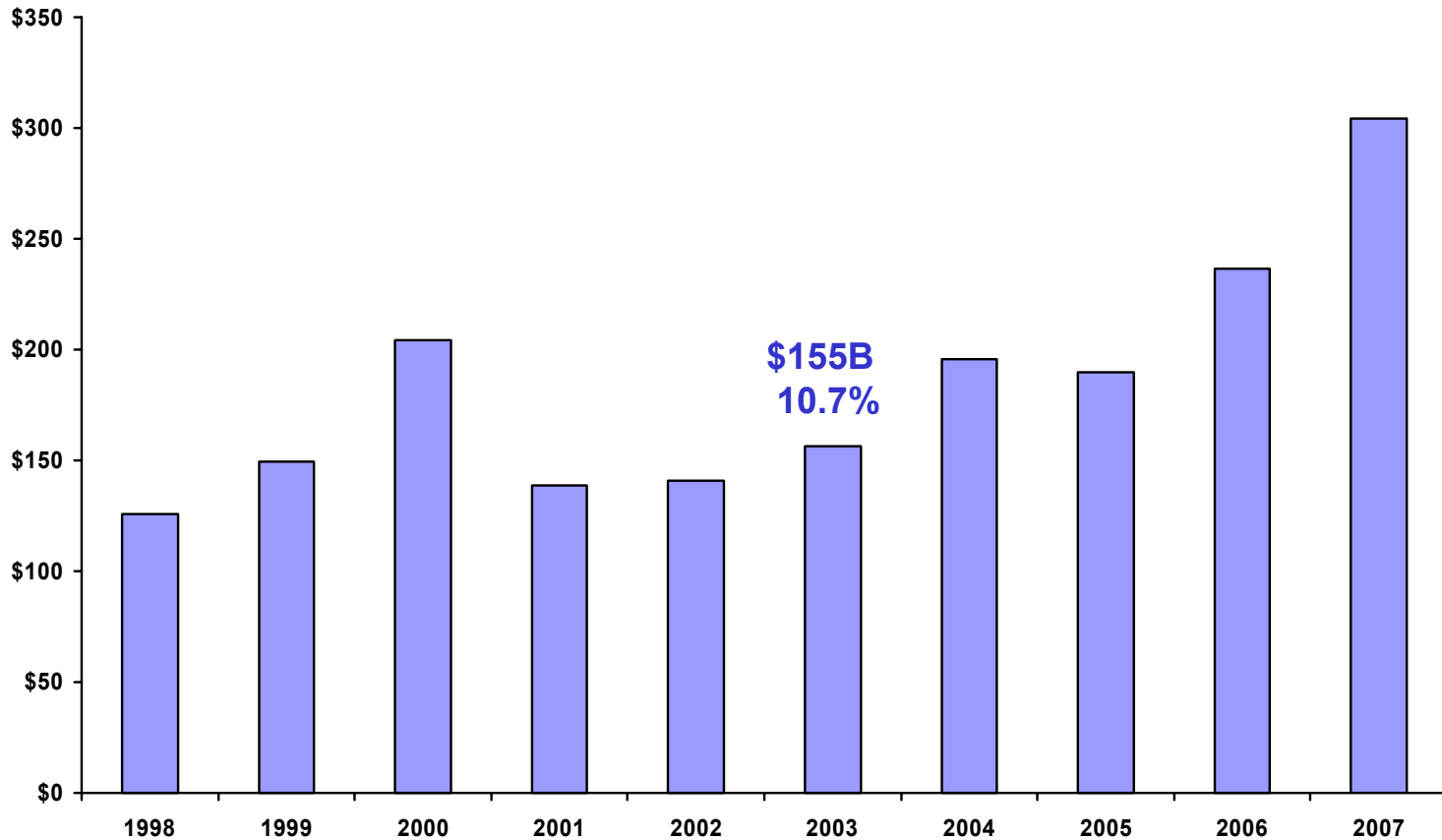
A Semiconductor Packaging Forecast

Topics

- **Semico Research Corp. Sales Forecasts**
- **Potential Markets for Sips**
- **The Economics of SiPs versus SoCs**
- **What needs to be done?**

Total Worldwide Semiconductor Sales Forecast

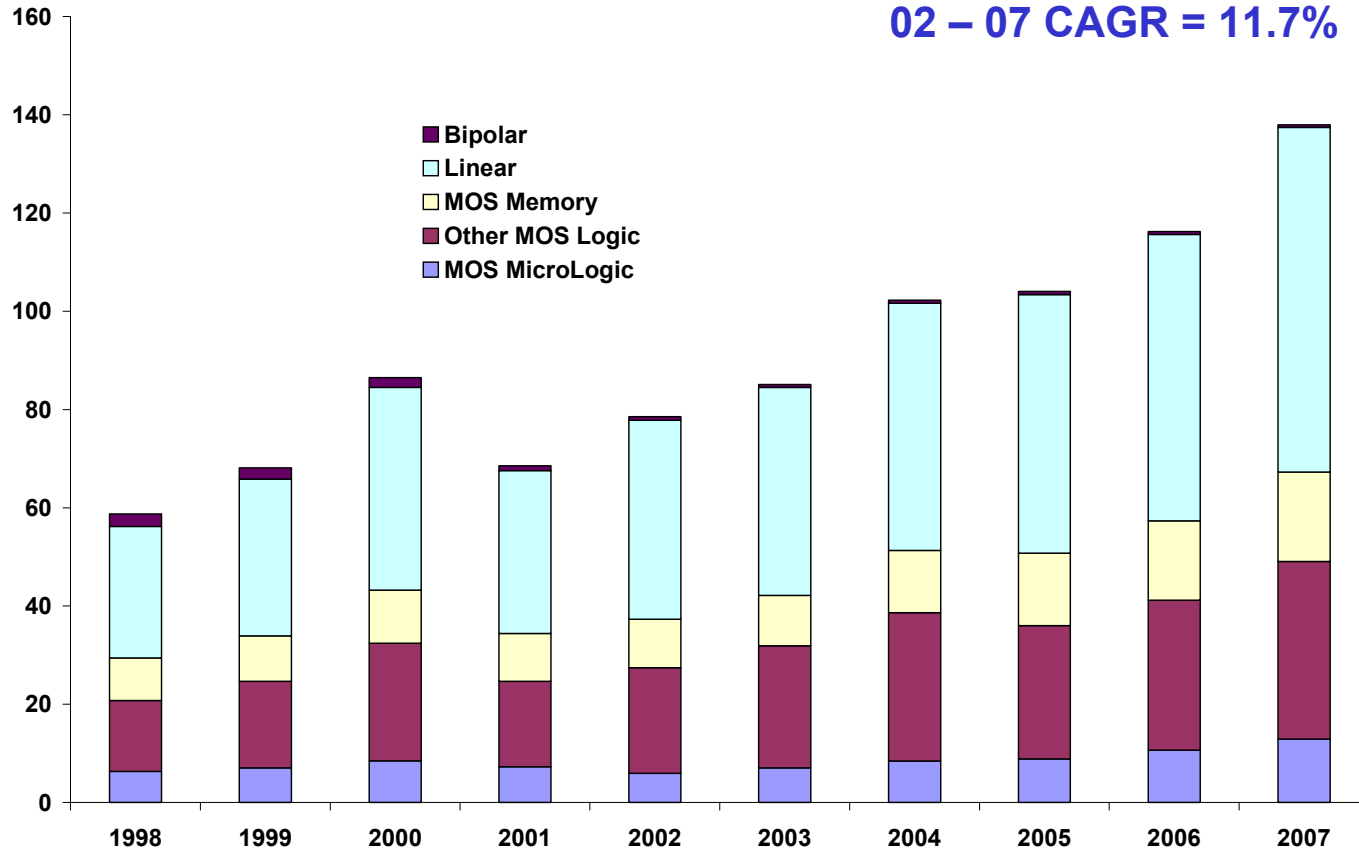
\$US Billions



Source: Semico Research Corp.

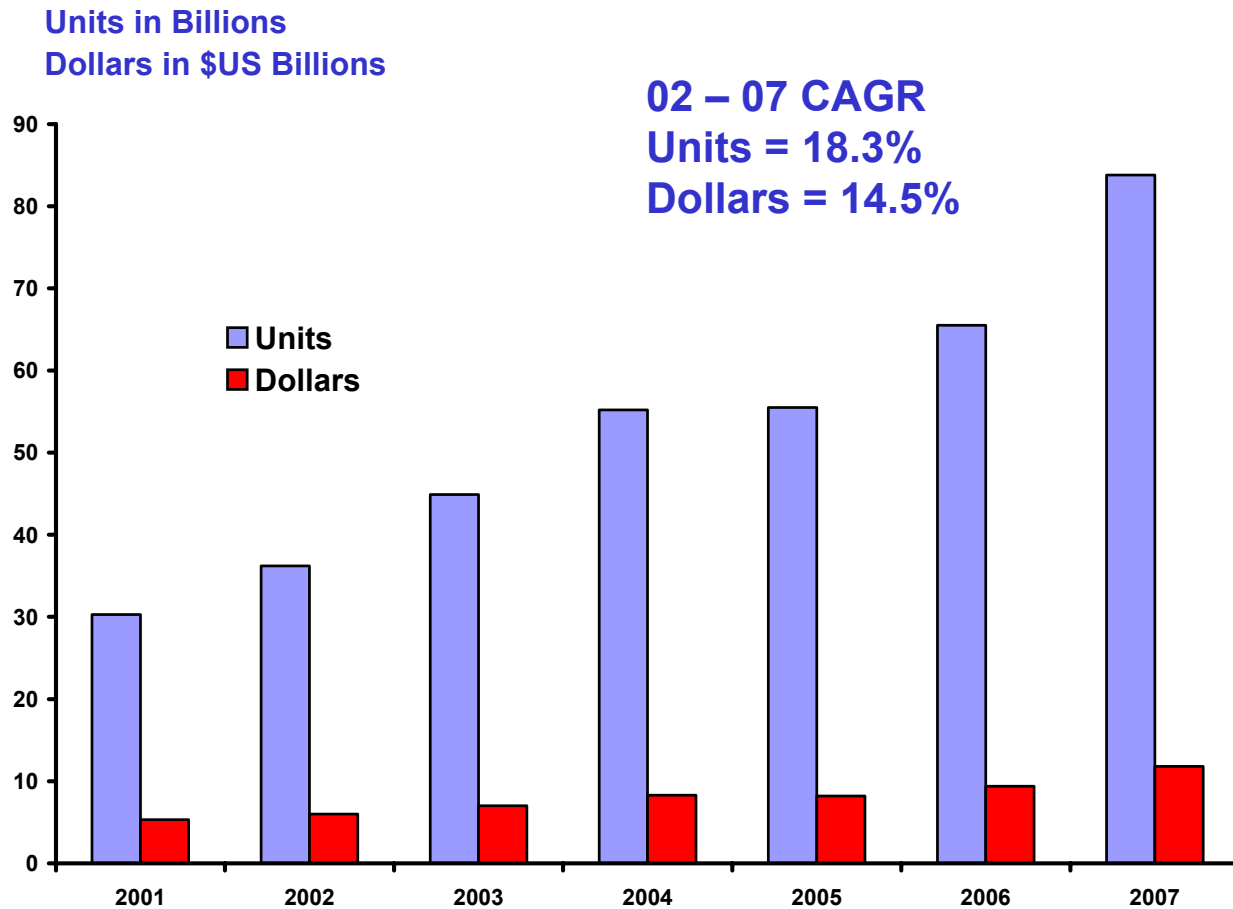
Total Worldwide IC Shipments Forecast

Units in Billions



Source: Semico Research Corp.

Total Worldwide IC Packaging Forecast (Sales by Semiconductor Packaging Companies)



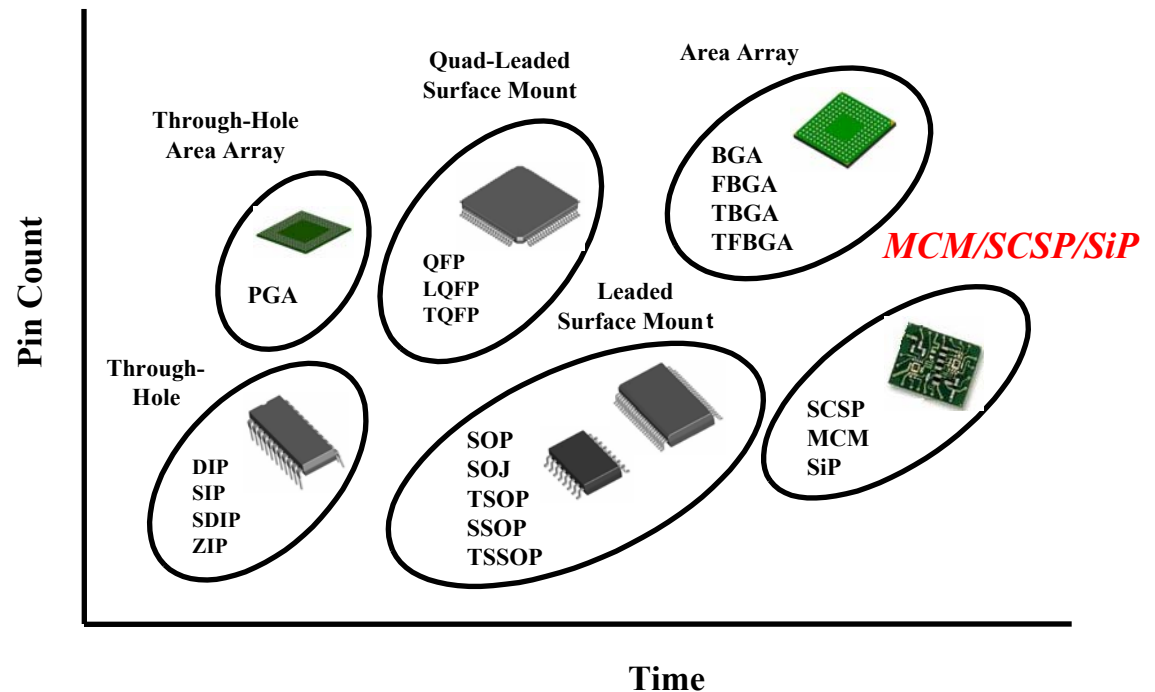
Source: Semico Research Corp.

What Contributes to Sales Growth for Semiconductor Packaging Companies?

- **Growth in Semiconductor Unit Shipments**
- **Outsourcing**
- **Integration Path Leads to More ICs in high-end packages**
- **SiP Packaging**

Semiconductor Packaging is a Driving Technology

- Smaller Packages
- Higher Pin Counts
- More Pins per Square Unit of Area
- More Cost Effective Mounting
- More Power

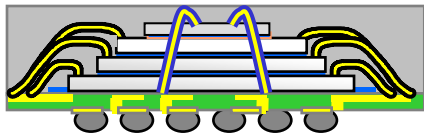


“We get no respect”

The Next Generation

SCSP

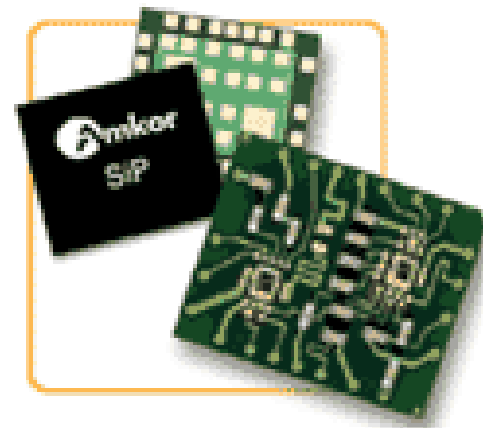
(Stacked Chip Scale Package)



Source: Intel

SiP

(System in Package)



Source: Amkor Technology

Definitions

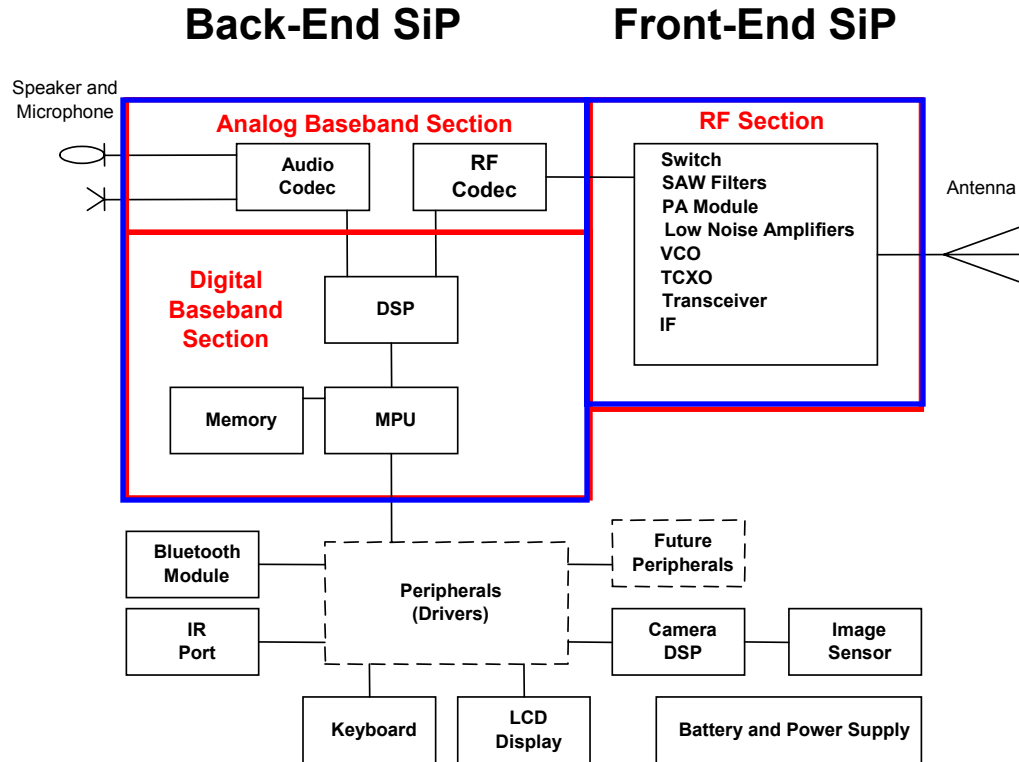
SCSP (Stacked Chip Scale Package)

A package that combines several dice vertically in a Chip Scale Package and electrically interconnects them to form a single device. Also called an MCP (Multichip Package)

SiP (System-in-Package)

A SiP is a package that combines all of the electronic components (digital ICS, analog ICs, RF ICs, passive components or other elements) needed to provide a system or subsystem in one package, essentially an alternative to an SoC.

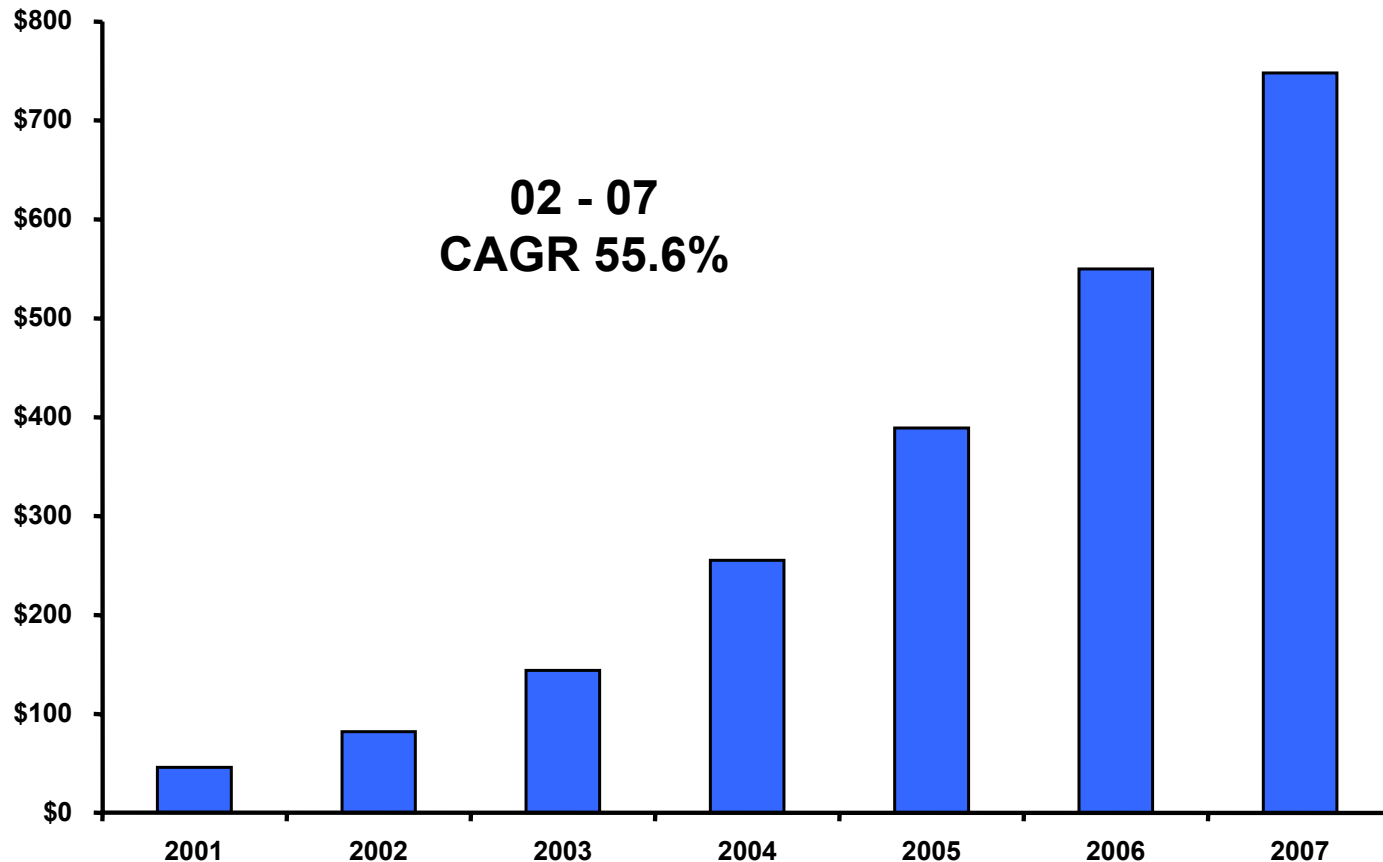
SiP Packaging: The New SoC



SiP Packaging Potential

- **Today's Vertical SiP Applications**
 - Cell Phones
 - Bluetooth
 - 802.11
 - CMOS Sensors

Semiconductor Packaging Companies SiP Packaging Revenue Forecast



SiP Packaging Potential

- **Today's Vertical SiP Applications**
 - Cell Phones
 - Bluetooth
 - 802.11
 - CMOS Sensors
- **Tomorrows Vertical SiP Markets**
 - Network Processors
 - PC Graphics
 - DC to DC Converters
 - More to Come

Tomorrow's Vertical Markets

The "More to Come"

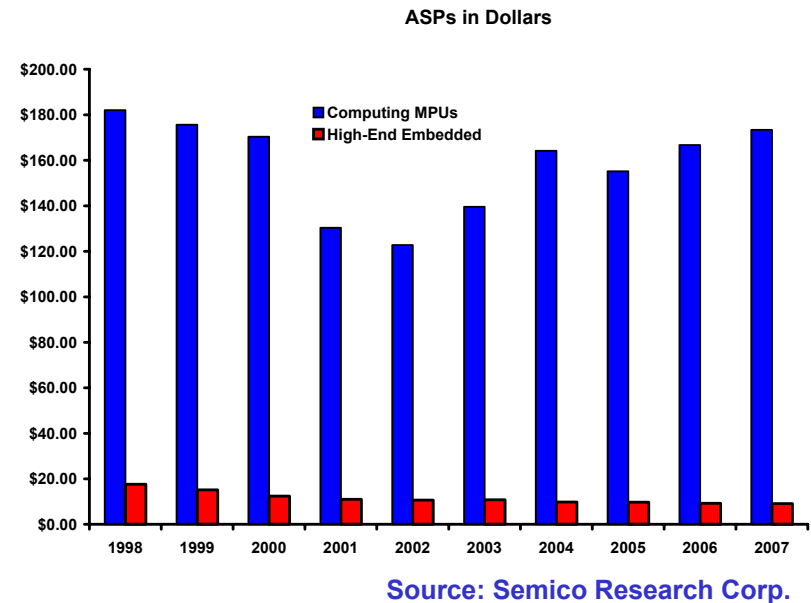
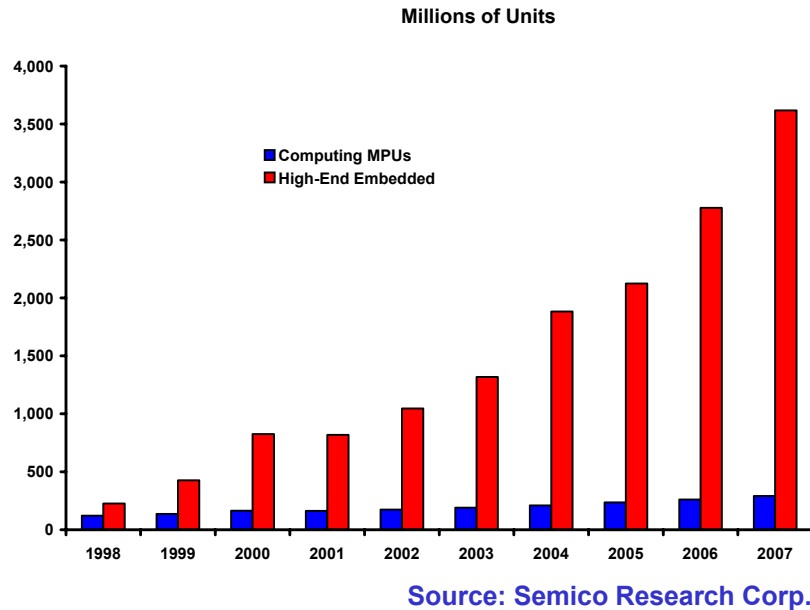
End-Use Markets	CAGR - 02-07	2007 Units
Integrated DTVs	134.6%	41.2
Smart Phones	44.4%	65.5
DVD Players	23.9%	145.8
Digital Cameras	21.6%	64.3
Digital Cordless Phones	20.9%	45.4
Digital Set Top Boxes	17.9%	65.2
DSL Modems	12.2%	31.9
Cell phones	6.8%	600.0

Source: Semico Research Corp. MAP Model

SiP Packaging Potential

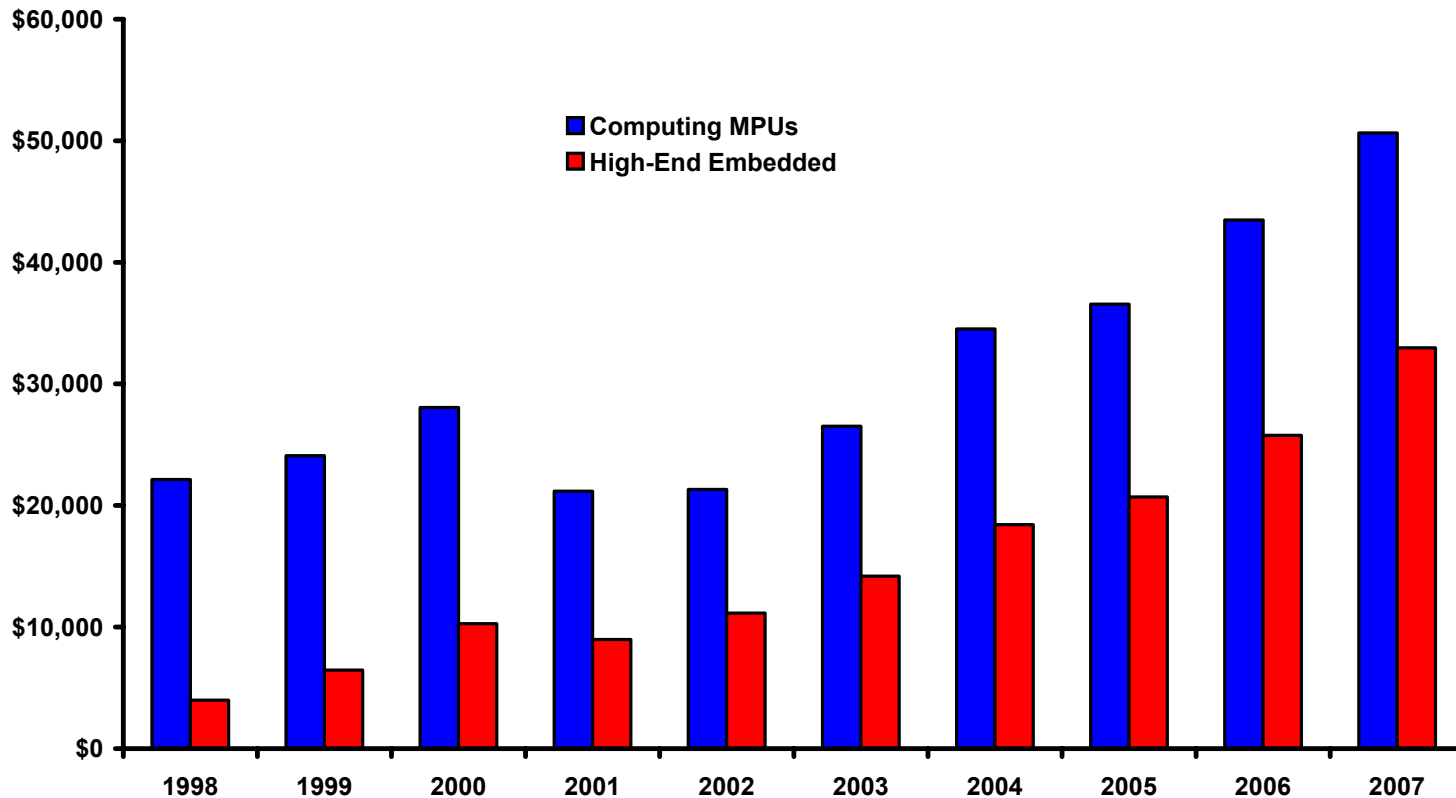
- **Today's Vertical SiP Applications**
 - Cell Phones
 - Bluetooth
 - 802.11
 - CMOS Sensors
- **Tomorrows Vertical SiP Markets**
 - Network Processors
 - PC Graphics
 - DC to DC Converters
 - More to Come
- **Horizontal Markets**
 - Tremendous potential for micrologic, memory and I/O in one package,

Vertical versus Horizontal Markets Example Micrologic Markets



Sales is What's Important!

Millions of Dollars



Source: Semico Research Corp.

What Creates the Horizontal Market Opportunity?

- **SiP Advantages versus SoCs**
 - Save space in space-critical application
 - Lower System Cost
 - Cheaper and smaller PC board
 - Less Insertion costs
 - ASIC portion can be less expensive
 - Performance advantage
 - More Reliable
 - Quicker Time-to-Market
 - **Economics: Far lower NRE than an SoC**

Economics of SoCs

NRE and 5X ROI

NRE	\$30M
5X ROI	\$150M

Source: Semico Research Corp.

Market Size Required

Market Share	Market Size Required
10%	\$1.5B
20%	\$750M
30%	\$500M
40%	\$375M
50%	\$300M

Source: Semico Research Corp.

SoC NRE and ASP per Unit

**If: Sales are \$150M and
Total NRE is \$30M**

Units	SoC ASP/Unit	SoC NRE/Unit
100 Million	\$1.50	\$0.30
25 Million	\$6.00	\$1.20
10 Million	\$15.00	\$3
1 Million	\$150	\$30
100 Thousand	\$1,500	\$300
10 Thousand	\$15,000	\$3,000

Source: Semico Research Corp.

SoC Market Requirements

- **At least a \$1.5B end-use market if market share is 10%**
- **At least 10M units (Maybe 25M) or ASP and NRE will be too high**

**SiPs are more economical than SoCs
in all but very high volume applications**

SiP vs. SoC NRE by Market Size Category

Category	Units	SoC NRE	SiP NRE
Very High Volume	100 Million	\$0.30	\$0.000
High Volume	25 Million	\$1.20	\$0.001
Medium Volume	10 Million	\$3.00	\$0.003
Volume	1 Million	\$30	\$0.03
Low Volume	100 Thousand	\$300	\$0.30
Very Low Volume	10 Thousand	\$3,000	\$3.00

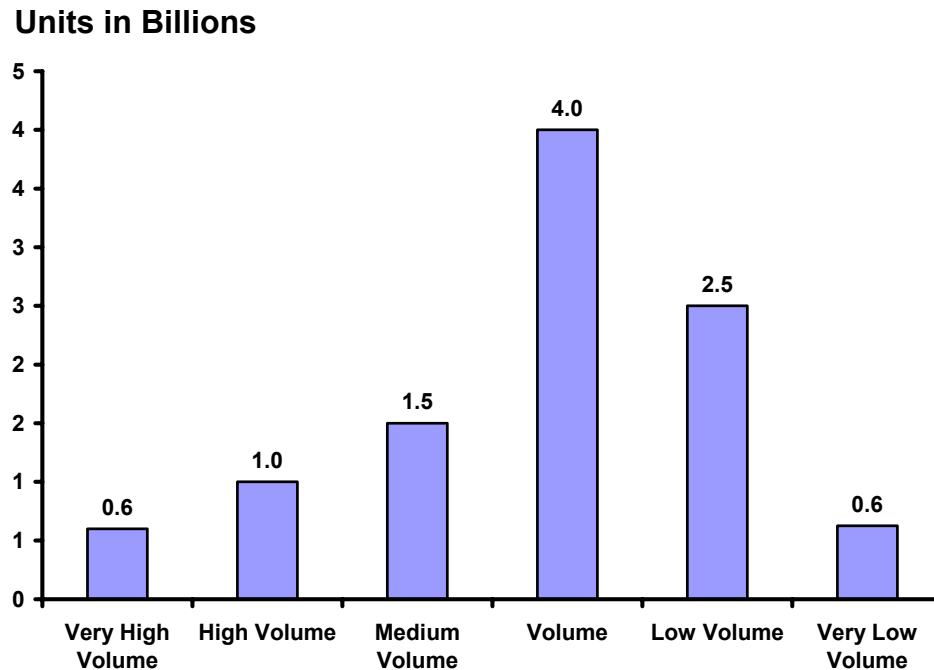
Source: Semico Research Corp.

(1) SoC NRE is \$30M

(2) SiP NRE is \$30K Max

Total Unit Shipments per Market Size Category

Average Units/Market X Number of Markets

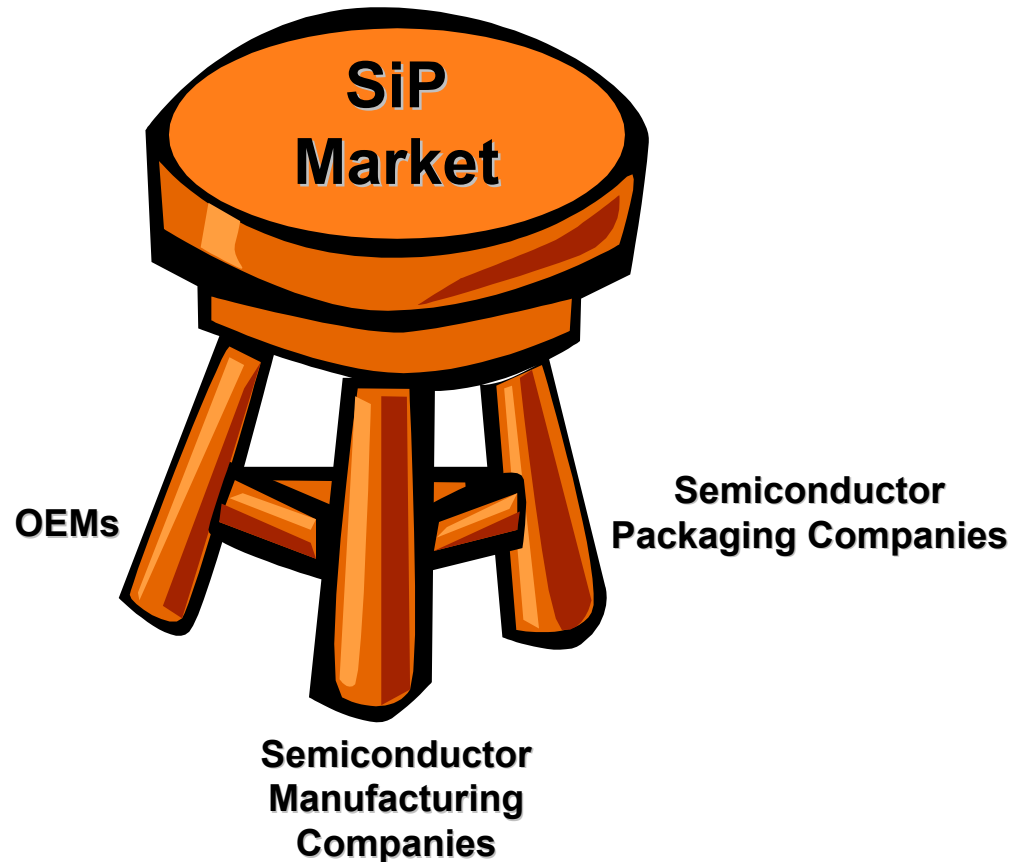


Source: Semico Research Corp.

SiP Market Potential

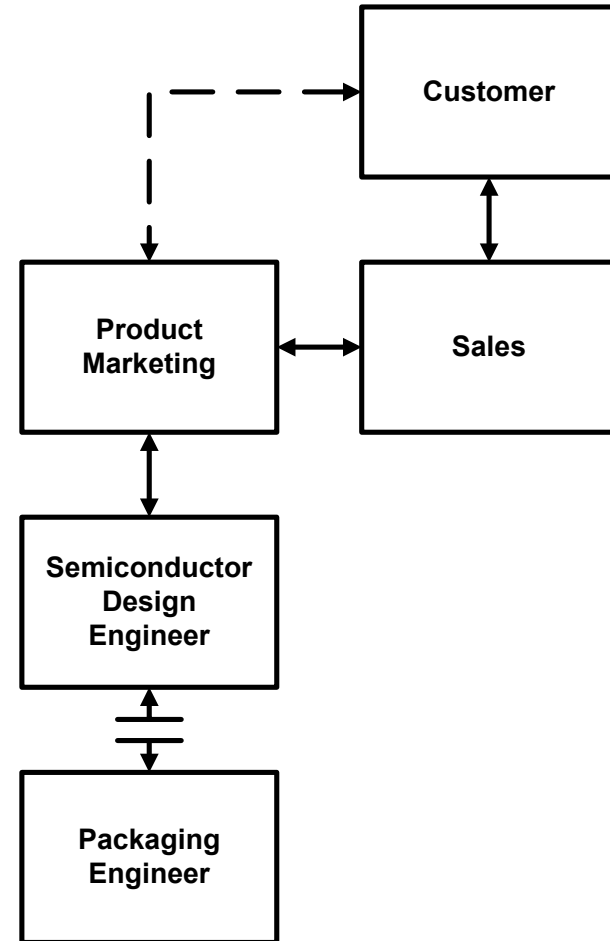
There is a very large market for unit volumes between 100K and 10M that SiPs can serve and SoCs can not

SiP Market Support



What Needs To Be Done?

- **Educate**
 - Customer
 - Sales
 - Product Marketing
 - Semiconductor Design Engineering
 - Management
- **Communicate: Semiconductor Design and Packaging Engineering**
- **Build an Infrastructure: Provide Customer Tools**



What is Semico Doing?

- **Studies**
 - PK101-03, “SiP Packaging: The New SoC?”
 - PK102-03: “Semiconductor Packaging Opportunities in High-Growth Consumer Markets”
 - Multi-Client Study, “SiP versus SoC Cost Comparison Model”
- **Data**
 - Functional Block Diagrams
 - Roadmaps
 - Market Sizes
 - Packages

Conclusions

- **Semiconductor IC Packaging Company Sales will grow at a CAGR of 14.5% for 2002 through 2007**
- **There is a huge upside opportunity**
 - SiPs are more economical than SoCs in all but very high volume applications
 - There is a very large potential market for SiPs in unit volumes between 100K and 10M
- **Semiconductor Manufacturers and Semiconductor Packaging Companies need to work together to build infrastructure and educate OEMs for the SiP market to reach it's potential**