THE WORLDWIDE IC PACKAGING MARKET, 2015 EDITION

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Chapter 1
Introduction

1.1 Objectives of the Report

For two decades, New Venture Research has been delivering market research services to the semiconductor industry through annual publications providing in-depth analysis of IC packaging technology and markets. Looking back to 1995, the semiconductor industry generated revenues of $125.5 billion, with shipments of ICs totaling a mere (by today's standards) 47.9 billion units. By 2014, the worldwide semiconductor market had more than doubled, to nearly $275 billion, with unit shipments totaling 220 billion chips annually. This 2015 edition is the latest installment of NVR's *Worldwide IC Packaging Market*, a comprehensive examination of the global integrated circuit packaging marketplace, with detailed analysis and forecasts of more than 40 different packaging types for 30 distinct categories of semiconductor devices.

This report aims to provide companies and individuals with statistical data that will enable them to understand the current status of the market, as well as anticipate market trends. Specifically, the report examines the two most current years (2013 and 2014) in terms of market size of the major packaging types, or families, and provides five-year forecasts of each to 2019.

The IC packaging marketplace is also examined from the point of view of the semiconductor device types that are being packaged—e.g., microprocessors, microcontrollers, memory, logic, etc.—and in terms of the applications for which they are used—computers, consumer products, communications, transportation, and industry. The report provides a particular focus on the OSAT market, the "outsourced semiconductor assembly and test" vendors who sell packaging services to other companies. In the final chapter, we provide profiles of forty of these OSAT competitors.

The Worldwide IC Packaging Market is designed to aid executives in senior management, as well as marketing and sales managers, to clarify market potential for current packaging products as well as to make critical strategic decisions about which new market segments to enter. The report will be beneficial to:

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- Foundries and other companies directly involved in chip packaging, as an aid to determining the demand for their own products
- Semiconductor manufacturers interested in how changes in packaging technology will impact (and be impacted by) advances in IC manufacturing techniques
- Companies interested in how the evolving IC packaging market is keeping pace with other changing markets, and ultimately how performance expectations of ICs will impact products purchased at the consumer level.

1.2 Scope of the Report

The IC packaging marketplace is extremely diverse, encompassing thousands of packaging types, ranging from simple 3- or 4-lead single and dual in-line plastic or ceramic packages to complex stacked packages with hundreds of I/O connections, and ranging in size from devices 50 mm or more on a side down to chip-scale packages barely larger than the bare die that they encase. Indeed, a growing number of applications are using bare die attached directly to a printed circuit board, eliminating the need for any traditional “package” at all. In this report, we segment this hugely complex market into the following thirteen major package “families”:

- Dual in-line packages (DIPs)
- Small outline transistors (SOTs)
- Small outline packages (SOs)
- Thin small outline packages (TSOPs)
- Dual flat pack no-lead packages (DFNs)
- Chip carriers (CCs)
- Quad flat packs (QFPs)
- Quad flat pack no-lead packages (QFNs)
- Pin grid arrays (PGAs)
- Ball grid arrays (BGAs)
- Fine-pitch ball grid arrays (FBGAs)
- Wafer-level packages (WLPs)

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- Direct chip attach ICs (DCAs)

We analyze each of these package families or packaging types in terms of the nature of the semiconductor devices that are packaged using one or another of the packaging techniques. Device types that are discussed include:

- Microprocessors (MPUs)
- Microcontrollers (MCUs)
- Digital signal processors (DSPs)
- Memory: DRAM, flash, ROM, and EPROM
- Logic: digital bipolar, gate array, display drivers
- Special-purpose logic: consumer, computer, communications, automotive, and multipurpose/other
- Analog devices: amplifiers and comparators, interfaces, data converters
- Application-specific analog devices: consumer, computer, communications, automotive, industrial/other

The market analyses provided throughout this report include discussions of unit shipments, packaging-related revenues, and average sales prices. Most data tables cover the historical years 2013 and 2014, with forecasts provided from 2015 through 2019. We explore both the total worldwide IC market and the OSAT market, the latter comprising a subset of the worldwide IC packaging market. Forecasts of packaging types are further broken down by I/O-count range.

1.3 Report Organization

1.3.1 Methodology

The information presented in this report was gathered from a variety of primary and secondary sources. The primary sources were marketing and business development managers at semiconductor manufacturers (primarily OSATs) who were contacted to participate in our industry survey. In most cases, the answers to the survey were delivered as written responses. In other cases, individuals were contacted directly for telephone interviews. Historical data related to devices presented in Chapters 4, 5, and 6 were based in part on the SIA's World

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Semiconductor Trade Statistics (WSTS) database, while IC packaging data and forecasts were developed by New Venture Research using a proprietary methodology.

The secondary sources included company literature, such as press releases, investment reports (e.g., annual reports and SEC filings), white papers, and information published on Web sites, both by the companies involved and by other organizations. We also obtained data from online databases and trade publications.

1.3.2 Chapter Outline

This report is organized into eight chapters, plus an appendix and a glossary:

- Chapter 1 - Introduction - Outlines the scope and organization of the report.
- Chapter 2 - Executive Summary - Provides an overview of the market and highlights of the top-level market segments.
- Chapter 3 - Economic Outlook and Worldwide Electronics Industry Forecast - Focuses on the global economy and its impact on the worldwide semiconductor markets.
- Chapter 4 - IC Packaging Overview and Total Worldwide Market Analysis - Provides an overview of the entire IC packaging market, including a brief description of the thirteen IC package families as well as forecasts of the total market.
- Chapter 5 - IC Packaging Market Analysis by Semiconductor Device - Presents historical and forecast data for semiconductor devices in terms of unit shipments and revenues; also presents an analysis of application markets for IC devices.
- Chapter 6 - IC Packaging Market Analysis by Package Family - Presents the thirteen major packaging families with segmentation by I/O range for each package type.
- Chapter 7 - OSAT Market and Strategy Analysis - Presents an overview of the outsourced semiconductor assembly and test market—a subset of the total IC packaging market—as well as forecasts and market trends.
- Chapter 8 - OSAT Company Profiles - Short profiles of selected OSAT vendors. Each includes a brief company overview and a description of the company's IC packaging product lines.
- Appendix - IC Packaging/Device Matrix, 2014 - A table showing which devices are packaged in which packaging types by I/O count.

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- Glossary of Packaging Terms - Industry acronyms and definitions of many terms used in the semiconductor and IC packaging industries.

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