THE WORLDWIDE IC PACKAGING MARKET

2016 EDITION

New Venture Research Corp.
337 Clay Street, Suite 101
Nevada City, CA 95959
(Tel) 530-265-2004
(Fax) 530-265-1998

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ABOUT THE AUTHOR

Jerry Watkins is an independent senior analyst with more than 20 years of experience in the field of market research and consulting. He has worked for leading research companies such as Frost & Sullivan, Lucid Information Services, and NSI Research both in management and as a writer. Mr. Watkins has authored many syndicated reports, previously in the telecommunications sector and more recently in the computing and merchant embedded computing industry as well as several reports or semiconductor packaging markets. He holds two university degrees: a B.A. in History and an M.A. in International Studies.

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337 Clay Street, Suite 101
Nevada City, California 95959

Tel: (530) 265-2004 • Fax: (530) 265-1998
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Chapter 1
Introduction

1.1 Objectives of the Report

This report, *The Worldwide IC Packaging Market, 2016 Edition*, provides a comprehensive examination of the global marketplace of integrated circuits (ICs), both devices and the various types of packaging developed for ICs. In the pages of this report, New Venture Research (NVR) presents detailed analyses of key market trends and provides forecasts for the major categories of ICs, as well as the principal IC packaging families, segmented according to various criteria, such as leads and I/O count, applications, and major world regions.

This report is intended as an aid for executives and senior management, as well as marketing and business development managers, of the many companies involved in the semiconductor industry, as they make decisions about which electronics products and technologies will be most critical in the future. The research found here will provide companies and organizations with the data they need to enable them to anticipate the forces that will drive future market growth, and to make informed decisions about which market segments will be most important for their own strategic growth. Specifically, this report will be beneficial to:

- OSATs, foundries, and other companies directly involved in wafer fabrication and chip packaging, as an aid to determining the demand for their own products
- Semiconductor equipment manufacturers interested in understanding 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

This 2016 edition of *The Worldwide IC Packaging Market* marks twenty years of continuously tracking and analyzing the global integrated circuits packaging marketplace. The

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first worldwide IC packaging report released by New Venture Research (then known as Electronic Trend Publications) was published in 1996. During the intervening 20 years, semiconductors, as well as integrated circuit (IC) assembly and test, have undergone tremendous change and growth. Our early research established that, in 1995, semiconductor devices generated revenues of $125 billion, with IC packaging accounting for about $12.9 billion of the total. Unit shipments of ICs totaled just 47.9 billion units. By 2015, annual revenues for ICs had more than doubled, IC packaging revenues had climbed by close to four times, and the number of devices shipped each year had grown by nearly eight times. More remarkably, while that first report detailed just six major IC packaging types then being manufactured, the present report provides analysis and forecasts for 14 IC packaging families, including—for the first time in our reports as a separate market segment—transistor outline packages.

Altogether this report details unit shipments, revenues, and pricing for 31 separate IC device types and 44 IC packaging market segments. Numerous tables and charts cover the historical years 2014 and 2015, with five-year forecasts from 2016 through 2020. (It should be noted that, as this report is being written near the end of 2016, the data for that year can be considered fairly accurate, although precise numbers will not be known until after the new year.) ICs are also examined in terms of applications—computers, consumer products, communications, automotive, and industry—and in terms of major world regions—North America, Europe, China, Japan, and the rest of the world (ROW). Setting the stage for the chapters on ICs and IC packaging is a discussion of the worldwide economic trends and the global electronics industry, specifically looking at products that are helping drive demand for ICs and especially advanced IC packaging technologies.

Individual IC devices covered in this report include:

- Discrete transistors (new in the report)
- Processors: Microprocessors (MPUs), microcontrollers (MCUs), and digital signal processors (DSPs)
- Memory: DRAM, flash, ROM, EPROM, and EEPROM
- Logic: Digital bipolar, gate array, PLDs, and display drivers
- Special-purpose logic: Consumer, computer, communications, automotive, and multipurpose/other
- Analog devices: Amplifiers and comparators, interfaces, data converters

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- Application-specific analog devices: Consumer, computer, communications, automotive, industrial/other

All of these IC devices are segmented according to the types of packages into which they are embedded, with further delineation according to the number of I/Os the packages are equipped with. The major package "families" are:

- Transistor outline packages (TOs) (new in the report)
- Dual in-line packages (DIPs)
- Small outline transistors (SOTs)
- Small outline packages (SOs)
- Thin small outline packages (TSOPs)
- Chip carriers (CCs)
- Quad flat packs (QFPs)
- Dual flat pack no-lead packages (DFNs)
- 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)
- Direct chip attached ICs (DCAs)

The report includes a particular focus on the OSAT market, the "outsourced semiconductor assembly and test" vendors that provide IC packaging and testing services to other companies. In Chapter 7, we provide profiles of 41 of these OSAT competitors.

1.3 Report Organization

1.3.1 Chapter Outline

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

- Chapter 1 - Introduction - Outlines the scope and organization of the report.

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- 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, as well as market trends for selected electronics products.
- Chapter 4 - Semiconductor Device Market Analysis - Presents historical and forecast data for integrated circuits in terms of unit shipments and revenues; also presents an analysis of application markets for IC devices, and regional distribution of IC device revenues.
- Chapter 5 - IC Packaging Overview and Total Worldwide Market Analysis - Provides an overview of the entire IC packaging market and discusses the fourteen major packaging families with segmentation by I/O range for each package type.
- Chapter 6 - 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 7 - OSAT Company Profiles - Describes business and technology strategies of 41 OSAT vendors, with a brief company overview and a description of each company's IC packaging product lines.
- Chapter 8 - Appendices - Glossary of Packaging Terms - Industry acronyms and definitions of many terms used in the semiconductor and IC packaging industries

  IC Packaging/Device Matrix, 2015 - A table showing which devices are packaged in which packaging types by I/O count

1.3.2 Methodology

The information presented in this report was gathered from a variety of primary and secondary sources.

Some 80 individual business or marketing managers at more than 60 companies (mostly OSATs) were contacted and asked to participate in our industry survey consisting of a standardized series of questions related to their IC packaging products. The primary goal of the questions was to get a "fix" on the marketplace, to understand the current status of the demand for products and the direction in which the industry is heading. To ground our

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assumptions in reality, we relied on our own previous reports, as well as historical data obtained from other sources, including the SIA's World Semiconductor Trade Statistics (WSTS) database. Based on the survey responses we received and the historical data we compiled, we developed a framework for forecasting the future path the market is likely to take.

The secondary sources we consulted 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.

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