
THE ARRAY IC PACKAGING MARKET

2013 EDITION

**Copyright © 2013
New Venture Research Corp.
337 Clay Street, Suite 101
Nevada City, CA 95959
(Tel) 530-265-2004
(Fax) 530-265-1998**

All rights reserved

ABOUT THE AUTHOR

Sandra L. Winkler has been an industry analyst starting in 1988, and from 1995 has been a staff member of Electronic Trend Publications, now New Venture Research Corporation. She has produced numerous off-the-shelf and custom reports throughout her career. She began her analyst career in the telecommunications industry, with Frost and Sullivan, and since 1995 has focused on the semiconductor packaging industry, authoring more than 30 widely cited reports on the topic, most notably *The Worldwide IC Packaging Market*, *Advanced IC Packaging Markets and Trends*, and *IC Packaging Materials*. She is a contributing editor and writer for Chip Scale Review magazine, Global SMT & Packaging News, and contributes to the IEEE/CPMT newsletter and other media. Ms. Winkler earned an MBA from Santa Clara University and is on the executive planning committee of the IEEE/CPMT Santa Clara Valley chapter, serving as Luncheon Program Chair.

ABOUT NEW VENTURE RESEARCH CORPORATION

New Venture Research (NVR) was formed in 1988 to assist industry executives in their decision making. We began as an independent consultancy and have recently evolved into a publisher of off-the-shelf market research reports in key areas of the electronics industry. The reports are written by a team of staff analysts and independent consultants. We also offer consulting services when our clients need information not found in our reports.

The backbone of each report is based upon primary market research information. Our market information originates from direct interviews with vendors, users, and other industry participants. We use secondary research to test for reasonableness, technical backgrounds, and, in some cases, for top-level forecasts. We distill the research into coherent forecasts and recommendations.

We are dedicated to providing our customers with accurate reporting on our targeted markets. One of our reports can save our customers months or years of research. The reports enable executives to make decisions in a structured manner. Our customers tell us these reports are excellent tools for building consensus regarding their company's real market opportunities.

NEW VENTURE RESEARCH

337 Clay Street, Suite 101
Nevada City, California 95959

Tel: (530) 265-2004 • Fax: (530) 265-1998

www.newventureresearch.com

DISCLAIMER

The author and publisher have used their best efforts to assure the accuracy of the material used in preparing this report.

The author and publisher make no warranty of any kind, expressed or implied, with regard to the information contained in this report. The author and publisher shall not be liable in any event for incidental or consequential damages in connection with, or arising from, the information contained in this report.

Any reference to particular products or manufacturers to illustrate points made in this report should not be construed as an endorsement of said products or manufacturers.

The opinions contained herein are those of the author and are based upon published and unpublished information obtained from a variety of sources, telephone and personal interviews with industry participants, and many years of experience.

SOFTWARE LICENSE AGREEMENT

This report is provided in PDF electronic file format. For considerations received, New Venture Research Corp. (NVR) hereby licenses this electronic copy of the report as described in this License Agreement to “You” the corporate or individual licensee. This License Agreement applies to all electronic file copies of the report for which you have purchased or otherwise been granted a license by NVR. Any use of the electronic file copy of the report indicates your acceptance of these terms.

The report and all electronic copies thereof are protected by both United States copyright law and international treaty provisions. You may not distribute any portion of the report. Unless otherwise specified in your purchase agreement with NVR, the electronic file copy of the report may be freely moved from one computer location to another, but may not be used by more than one (1) person simultaneously.

THE ARRAY IC PACKAGING MARKET – 2013 EDITION

Table of Contents

Chapter 1 INTRODUCTION	1
1.1 Background	1
1.2 Scope.....	1
1.3 Organization.....	1
1.4 Methodology.....	2
Chapter 2 EXECUTIVE SUMMARY	4
2.1 Overview	4
2.2 BGA / FBGA Solutions	5
2.3 Fan-In QFN Package Solutions	7
2.4 Fan-Out WLP Solutions	9
Chapter 3 TECHNICAL TRENDS	12
3.1 World and Semiconductor Overview.....	12
3.2 Not All Economies Recovering Equally; Unrest Remains	12
3.3 World GDP	13
3.4 Global Electronics Market.....	18
3.5 Electronics Industry Summary Forecast.....	20
3.5.1 Communications	21
3.5.1.1 Cellular Handsets	23
3.5.1.2 Cellular Infrastructure	24
3.5.1.3 Other Phones	25
3.5.1.4 Enterprise LANs.....	25
3.5.1.5 Wireless LANs.....	25
3.5.1.6 DSL and Cable Modems	26
3.5.1.7 PBX/Other CPE	26
3.5.1.8 Carrier-Class Equipment	27

3.5.2	Computers.....	27
3.5.2.1	Personal Computers.....	30
3.5.2.2	Tablets.....	30
3.5.2.3	Servers.....	30
3.5.2.4	Workstations.....	31
3.5.2.5	Enterprise Storage Systems	31
3.5.2.6	Flash Drives	31
3.5.2.7	Monitors.....	32
3.5.2.8	Printers.....	32
3.5.2.9	E-Readers	33
3.5.3	Consumer	33
3.5.3.1	Televisions.....	36
3.5.3.2	Set-Top Boxes.....	36
3.5.3.3	DVD Players/Recorders	37
3.5.3.4	Digital Cameras	37
3.5.3.5	Console Video Games	38
3.5.3.6	MP3 Players.....	38
3.5.3.7	Personal Navigation Devices.....	38
3.5.3.8	Memory Cards.....	38
3.5.4	Industrial	39
3.5.5	Medical.....	40
3.5.6	Automotive	42
3.5.7	Commercial Aviation, Defense, and Other Transportation	43
Chapter 4 BGA/LGA and FBGA/FLGA Package Solutions		46
4.1	Overview	46
4.2	BGA	47
4.3	FBGA.....	47
4.4	New Product Introductions.....	48
4.4.1	Kyocera SLC Technologies Corporation and IBM	48
4.5	Forecasts for BGA, LGA, CGA, FBGA, and FLGA Package Solutions	49

4.5.1	BGA Package Family	49
4.5.2	FBGA Package Family.....	54
Chapter 5 QUAD FLATPACK NO-LEAD (QFN) and FAN-IN QFN PACKAGES.....		63
5.1	Overview	63
5.2	Product Introductions.....	65
5.3	Market Forecasts for Fan-In QFN Packages	65
Chapter 6 - WAFER LEVEL PACKAGES (WLPS) AND FAN-OUT WLPS.....		68
6.1	Wafer-Level Package Overview	68
6.1.1	WLP or Flip Chip on Board?.....	69
6.1.2	The Layers	70
6.1.3	Benefits of a WLP	71
6.1.4	Wafer-Applied Underfill.....	71
6.1.5	Wafer Testing.....	73
6.1.6	Compliance to the PCB.....	74
6.1.7	Issues and Solutions	74
6.1.8	Cost Reduction for WLPS.....	77
6.1.9	Current Applications	77
6.1.10	Versatility of the WLP	78
6.2	Fan-Out WLPS	78
6.2.1	FOWLPS Challenges	79
6.3	New Product Introductions.....	80
6.3.1	Deca Technologies	80
6.3.2	J-Devices Corporation.....	85
6.3.3	NANIUM S.A.....	89
6.3.4	STATS ChipPAC, Limited.....	90
6.3.5	Teramikros, Inc.	91
6.4	Market Forecasts for WLPS.....	92
6.4.1	WLP Forecast.....	92
6.4.2	Forecast of Fan-Out WLPS	94
Appendix A WEBSITE ADDRESS GUIDE		98

OSAT Website Guide 98
Appendix B Glossary..... 105

Chapter 1

INTRODUCTION

1.1 Background

The high demand for today's handheld electronics is requiring package solutions which can accommodate more I/O and more functionality than ever before.

Array packages fit that bill by allowing for more than just one row of I/O around the underside of the package as it attaches to the printed circuit board (PCB). Array packages are covered in this report which is described within.

1.2 Scope

This report covers these basic topics:

- BGA/LGA/CGA and FBGA/FLGA Packages
- QFN and Fan-In QFN Solutions
- WLP and Fan-Out WLP Solutions

1.3 Organization

This report is divided into six chapters and two appendices. They are as follows:

Chapter 1, Introduction: This chapter outlines the background, scope, organization, and methodology of the report.

Chapter 2, Executive Summary: This chapter provides summary forecasts and information.

Chapter 3, Economic Outlook and Worldwide Electronics Industry Forecast, is an overview of the state of the overall economy and semiconductor industry.

Chapter 4, BGA/LGA/CGA and FBGA/FLGA Package Solutions, breaks down the BGA and FBGA package families by their interconnections to the PCB by virtue of balls, land pads, or columns.

Chapter 5, Quad Flat Pack and Fan-In QFN Packages, covers the QFN package solution with emphasis on the Fan-in QFN package, which expands the I/O range which can be obtained with this package by adding additional rows of leads towards the interior of the package for an array pattern. Two or three rows are common at this time, turning this leadframe package into an array package solution.

Chapter 6, Wafer-Level Packages and Fan-Out WLPS, delves into the WLP market which includes the Fan-out WLP. The Fan-out WLP expands the number of I/O to beyond the perimeter of the die to form an array pattern on an overmold placed around the die during assembly. This increases the potential I/O count from what can otherwise be achieved on a WLP solution, while taking advantage of wafer level efficiencies.

Appendix A, Website Address Guide: This appendix contains the Internet addresses of the companies presented in this report, plus the OSAT companies that serve the IC packaging industry.

Appendix B, Glossary: This appendix contains a general glossary of terms used in the IC packaging industry.

1.4 Methodology

Information was obtained from both primary and secondary sources to complete this report. Information was gathered by telephone, e-mail, at trade shows, from speakers at seminars, conferences, luncheons and dinners, and by visiting companies in the industry. Secondary sources of information included company literature, trade magazines, seminar proceedings, and the Internet, and often led to further primary contact.

Hundreds of individuals were contacted for information for this report. They included key people within all of the major semiconductor fabrication companies and IC package foundries around the globe. Information was obtained using standard surveys and is printed only in the aggregate. The survey questions were designed to

determine the size of the market and likely growth patterns and to elicit responses about issues and developments in this particular area of the packaging industry. Discussions with those in the industry also played a key part in gathering information for this report.

A wide assortment of companies providing products and services for this market was contacted as well. Information was gathered in person when possible; company literature and white papers from seminars and proceedings were also heavily utilized.