

INTRODUCTION	xx
STUDY GOALS AND OBJECTIVES.....	xx
REASONS FOR DOING THE STUDY	xx
SCOPE AND FORMAT	xxi
ABOUT THE AUTHOR.....	xxii
INFORMATION SOURCES.....	xxii
RELATED BCC REPORTS	xxii
BCC ONLINE SERVICES.....	xxiii
DISCLAIMER	xxiii
EXECUTIVE SUMMARY	xxiv
<i>SUMMARY TABLE GLOBAL MARKET FOR IN-HOUSE AND</i>	
<i>OUTSOURCED PACKAGING AND TESTING, THROUGH 2011</i>	
<i>(\$ BILLIONS).....</i>	<i>xxv</i>
<i>SUMMARY FIGURE GLOBAL MARKET FOR IN-HOUSE AND</i>	
<i>OUTSOURCED PACKAGING AND TESTING SALES, 2006 AND 2011</i>	
<i>(\$ BILLIONS).....</i>	<i>xxvi</i>
TECHNOLOGY LANDSCAPE	1
TECHNOLOGY LANDSCAPE.....	1
TECHNOLOGY LANDSCAPE (Continued)	2
<i>FIGURE 1 POSITION OF PACKAGING AND TESTING IN</i>	
<i>SEMICONDUCTOR MANUFACTURING CYCLE</i>	<i>3</i>
TYPES OF ADVANCED PACKAGING TECHNIQUES.....	3
TYPES OF ADVANCED PACKAGING ... (CONTINUED)	4
PACKAGE FOOTPRINT REDUCTION: CHIP SCALE	
PACKAGE (CSP)/WAFER LEVEL PACKAGING (WLP).....	5
Introduction	5
<i>TABLE 1 GLOBAL MARKET FORECAST FOR OSPT CSP/WLP SALES,</i>	
<i>THROUGH 2011 (\$ BILLIONS)</i>	<i>6</i>
Background.....	6
Applications and Case Studies.....	6
<i>TABLE 2 GLOBAL MARKET FORECAST FOR OSPT CSP, BY SECTOR,</i>	
<i>THROUGH 2011 (\$ BILLIONS)</i>	<i>7</i>
<i>FIGURE 2 GLOBAL MARKET FORECAST FOR OSPT CSP, BY</i>	
<i>SECTOR, 2004-2011 (\$ BILLIONS)</i>	<i>8</i>
Case Study—CSP for High-Brightness LED	8
Features and Benefits	8
Size and Weight Efficiency	9
Ease of Implementation.....	9
Compatibility	9
Mismatch and Revision Elimination.....	9
Time to Market Reduction.....	10

Implementation Methodologies and Process	
Enhancements	10
CSP	10
WLP	11
Process Enhancement—Reduction in Particle	
Defects.....	11
Process Enhancement—Maxim Integrated Products.....	12
<i>FIGURE 3 WLP CROSS SECTION</i>	12
Process Enhancement—Tessera	12
<i>FIGURE 4 WLP-COMPLIANT LAYER</i>	13
Process Enhancement—Amkor	13
Limitations of CSP/WLP	13
Infrastructure Constraints	14
Cost Concerns	14
Operation Concerns	14
Challenges Associated with Wafer Level Test and	
Burn-in (WLTBI)	14
Global Distribution of OSPT Services Sales by Region	15
<i>TABLE 3 GLOBAL MARKET FORECAST FOR OSPT CSP:</i>	
<i>DISTRIBUTION BY REGION, THROUGH 2011 (\$ BILLIONS)</i>	15
PACKAGE-TO-PCB BONDING—PGA.....	15
Introduction	15
Features and Benefits	16
Lower Thermal Resistance and High Thermal Heat	
Dissipation	16
Better Signal Quality.....	16
High Reliability.....	16
Applications and Case Studies.....	16
Implementation Methodologies and Process	
Enhancements	16
Implementation Methodology—CPGA.....	17
Implementation Methodology—PPGA.....	17
PACKAGE-TO-PCB ATTACHMENT/BONDING: BGA.....	17
Introduction	17
<i>TABLE 4 GLOBAL MARKET FORECAST FOR OSPT BGA SALES,</i>	
<i>THROUGH 2011 (\$ BILLIONS)</i>	18
Applications and Case Studies.....	18
<i>TABLE 5 GLOBAL MARKET FORECAST FOR BGA: DISTRIBUTION</i>	
<i>BY SECTOR, THROUGH 2011 (\$ BILLIONS)</i>	19
<i>FIGURE 5 GLOBAL MARKET FORECAST FOR BGA, DISTRIBUTION</i>	
<i>BY SECTOR, 2004-2011 (\$ BILLIONS)</i>	19
Features and Benefits.....	20
High Density	20
Heat Conduction Efficiency	20

Low Inductance Leads	20
Implementation Methodologies and Process	
Enhancements	20
Implementation Methodologies ... (Continued).....	21
Implementation Methodology—PBGA.....	22
Implementation Methodology—FCBGA	22
Implementation Methodology—CBGA	23
Implementation Methodology—TBGA.....	23
Implementation Methodology—EBGA	23
Process Enhancement—Ball Placement Equipment.....	23
Process Enhancement—SolVision.....	24
Limitations and Challenges	24
Unreliability of Solder Balls.....	24
Complicated, Expensive, and Incomprehensive	
Inspection Techniques	24
Difficulty in Rectification of Individual Solders	24
Inability to Withstand High Temperature	25
Sensitivity to Moisture	25
Global Distribution of OSPT Sales by Region	25
<i>TABLE 6 GLOBAL MARKET FORECAST FOR OSPT BGA,</i>	
<i>DISTRIBUTION BY REGION, THROUGH 2011 (\$ BILLIONS).....</i>	<i>25</i>
DIE-TO-PACKAGE SUBSTRATE ATTACHMENT/BONDING:	
FC	26
Introduction	26
<i>TABLE 7 GLOBAL MARKET FORECAST FOR OSPT FC, THROUGH</i>	
<i>2011 (\$ BILLIONS).....</i>	<i>26</i>
Applications and Case Studies.....	27
Case Study—Kyocera	27
Case Study—Migration from Wire Bond to FC	
Packaging.....	27
Case Study—Amkor.....	27
Case Study—ASAT	28
<i>TABLE 8 GLOBAL MARKET FORECAST FOR OSPT FC,</i>	
<i>DISTRIBUTION BY SECTOR, THROUGH 2011 (\$ BILLIONS).....</i>	<i>28</i>
<i>FIGURE 6 GLOBAL MARKET FORECAST FOR OSPT FC,</i>	
<i>DISTRIBUTION, BY SECTOR, 2004-2011 (\$ BILLIONS).....</i>	<i>29</i>
Features and Benefits	29
Size Efficiency	30
Speedy Interconnect.....	30
I/O Efficiency.....	30
Cost Benefits	30
Assembly Process Efficiency.....	30
Implementation Methodologies and Process	
Enhancements.....	30

<i>FIGURE 7 OERLIKON MICRON5003 FC BONDER</i>	31
Implementation Methodologies ... (Continued)	32
Implementation Methodologies ... (Continued)	33
Implementation Methodology—Electroless Nickel- Gold FC	34
Process Enhancement—Texas Instruments	34
Process Enhancement—Valtronics	35
Process Enhancement—Henkel	35
Process Enhancement—Stud Bumping	36
Process Enhancement—Precise Flux Deposition Mechanism	36
Limitations and Challenges	36
Spacing Constraints	37
Solder Processing Temperature and Material Restrictions	37
Costly Bumping Processes	37
Substrate Concerns	37
Underfill Process Trade-Offs	38
Global Distribution of OSPT Services by Region	38
<i>TABLE 9 GLOBAL MARKET FORECAST FOR OSPT FC, DISTRIBUTION BY REGION, THROUGH 2011 (\$ BILLIONS)</i>	38
MULTI-FUNCTIONAL INTEGRATION ON THE PACKAGE: MCM	38
Introduction	38
<i>TABLE 10 GLOBAL MARKET FORECAST FOR OSPT MCM, THROUGH 2011 (\$ BILLIONS)</i>	39
Applications and Case Studies	39
Case Study—IBM	39
Case Study—MCM in Optical Telecom Applications	40
Case Study—Orsys	40
<i>TABLE 11 GLOBAL MARKET FORECAST FOR OSPT MCM, DISTRIBUTION BY SECTOR, THROUGH 2011 (\$ BILLIONS)</i>	41
<i>FIGURE 8 GLOBAL MARKET FORECAST FOR OSPT MCM, DISTRIBUTION BY SECTOR, 2004-2011 (\$ BILLIONS)</i>	41
Features and Benefits	42
Better Performance	42
Improved Signal Quality	42
Size Reduction	42
Economic Advantages	42
Implementation Methodologies and Process Enhancements	43
Implementation Methodology—Laminated MCM (MCM-L)	44
Implementation Methodology—Ceramic MCM (MCM-C)	44

Thick Film.....	45
High Temperature Co-fired Ceramic (HTCC)	45
Low Temperature Co-fired Ceramic (LTCC)	45
Implementation Methodology—Deposited MCM	
(MCM-D)	45
Classic Thin-Film.....	46
Silicon Thin-Film	46
Polymer Thin-Film.....	46
Limitations and Challenges	46
Performance Inefficiencies	46
Architectural Constraints.....	47
Electrical and Thermal Constraints	47
Cost Constraints	47
Test Constraints.....	47
Global Distribution of OSPT Sales by Region	48
<i>TABLE 12 GLOBAL MARKET FORECAST FOR OSPT MCM,</i>	
<i>DISTRIBUTION BY REGION, THROUGH 2011 (\$ BILLIONS).....</i>	<i>48</i>
MULTI-FUNCTIONAL INTEGRATION ON THE PACKAGE:	
SIP	48
Introduction	48
<i>TABLE 13 GLOBAL MARKET FORECAST FOR OSPT SIP, THROUGH</i>	
<i>2011 (\$ BILLIONS).....</i>	<i>49</i>
Applications and Case Studies.....	49
Case Study—Wi2Wi.....	50
Case Study—NEC.....	50
Case Study—ChipMOS.....	50
Case Study—Toshiba.....	50
<i>FIGURE 9 SIP IN ULTRA-THIN HARD DRIVE.....</i>	<i>51</i>
<i>FIGURE 10 SIP IN MOBILE PHONE.....</i>	<i>52</i>
<i>TABLE 14 GLOBAL MARKET FORECAST FOR OSPT SIP,</i>	
<i>DISTRIBUTION, BY SECTOR, THROUGH 2011 (\$ BILLIONS).....</i>	<i>53</i>
<i>FIGURE 11 GLOBAL MARKET FORECAST FOR OSPT SIP,</i>	
<i>DISTRIBUTION BY SECTOR, 2004-2011 (\$ BILLIONS).....</i>	<i>53</i>
Features and Benefits	54
Size Efficiency	54
Performance Enhancement	54
Design and Review Flexibility.....	54
Cost Advantage	55
Reduced Time-to-Market.....	55
Implementation Methodologies and Process	
Enhancements	55
<i>FIGURE 12 CROSS SECTIONS OF FC AND WIRE-BONDED SIPS</i>	<i>56</i>
Limitations and Challenges	57
Limited Availability of Skills and Resources.....	57

Re-alignment of EDA Processes	57
Lack of KGD	58
Larger Package Size as Compared to SoC	58
Pressures on Wafering Process	58
<i>TABLE 15 GLOBAL MARKET FORECAST FOR OSPT SIP, DISTRIBUTION BY REGION, THROUGH 2011 (\$ BILLIONS)</i>	59
MULTI-FUNCTIONAL INTEGRATION ON THE PACKAGE:	
POP	59
Introduction	59
<i>TABLE 16 GLOBAL MARKET FORECAST FOR OSPT POP, THROUGH 2011 (\$ BILLIONS)</i>	60
Applications and Case Studies.....	60
Case Study—STATS ChipPAC.....	60
Case Study—STMicroelectronics	61
Case Study—Toshiba America Electronic	
Components	61
<i>TABLE 17 GLOBAL MARKET FORECAST FOR OSPT POP, DISTRIBUTION BY SECTOR, THROUGH 2011 (\$ BILLIONS)</i>	61
<i>FIGURE 13 GLOBAL MARKET FORECAST FOR OSPT POP, DISTRIBUTION BY SECTOR, 2004-2011 (\$ BILLIONS)</i>	62
Features and Benefits	62
Saving in Board Surface Area	63
Ease in System Design	63
Reduction in PCB Complexity	63
Enhanced Performance.....	63
Reduced Time-to-Market	63
Implementation Methodologies and Process	
Enhancements	63
<i>FIGURE 14 CROSS SECTION AND TOP VIEW OF PSVFBGA</i>	64
Process Enhancement—Intel	65
Limitations and Challenges	66
Conflict of Interests	66
Over Dependence on Solder Ball Material	
Characteristics.....	66
Pressure on PoP(d) Design	67
Global Distribution of OSPT Sales by Region	67
<i>TABLE 18 GLOBAL MARKET FORECAST FOR OSPT POP, DISTRIBUTION BY REGION, THROUGH 2011 (\$ BILLIONS)</i>	67
INDUSTRY ANALYSIS	68
<i>TABLE 19 GLOBAL MARKET FORECAST FOR SEMICONDUCTOR CHIPS TO ALL INDUSTRY SECTOR END PRODUCTS, THROUGH 2011 (\$ BILLIONS)</i>	68

<i>TABLE 20 SHARE OF TOTAL AND OUTSOURCED SEMICONDUCTOR PACKAGING AND SERVICES, THROUGH 2011 (%)</i>	69
<i>FIGURE 15 SHARE OF TOTAL AND OUTSOURCED SEMICONDUCTOR PACKAGING AND SERVICES, 2004-2011 (%)</i>	70
COMPETITION	70
CYCLICALITY	71
FUNDAMENTALS	72
DEMAND FLUCTUATIONS IN THE END PRODUCTS.....	73
CAPACITY UTILIZATION FLUCTUATIONS.....	73
PRICING PRESSURES	73
CHANGE IN MIX OF SEMICONDUCTOR PACKAGES.....	73
SHORT TERM CUSTOMER COMMITMENT DURATIONS.....	73
RAW MATERIAL AVAILABILITY AND PRICING FLUCTUATIONS	73
IP DISPUTES.....	74
NATURAL CALAMITIES.....	74
RISKS ASSOCIATED WITH OPERATIONS IN MULTIPLE NATIONS.....	74
BUYER/SUPPLIER INTERPLAY.....	75
PACKAGING SERVICES.....	75
TESTING SERVICES	75
OSPT SERVICE PROVIDER—IDM INTERPLAY.....	75
RAW MATERIALS and value added components FOR ADVANCED PACKAGING	76
DIELECTRICS AND SUBSTRATES	76
Market Overview and Update.....	77
SOLDERS.....	78
Market Overview and Update.....	79
SOCKETS AND INTERCONNECTS.....	79
Market Overview and Update.....	80
UNDERFILLS	80
THERMAL MANAGEMENT SOLUTIONS.....	80
Market Overview and Update.....	81
WHY OUTSOURCE?	81
<i>TABLE 21 SHARES OF OSPT SERVICES AND IN-HOUSE SEMICONDUCTOR PACKAGING AND TESTING SERVICES MARKETS, THROUGH 2011 (%)</i>	82
<i>FIGURE 16 SHARES OF OSPT SERVICES SALES AND IN-HOUSE SEMICONDUCTOR PACKAGING AND TESTING SERVICES MARKETS, 2004-2011 (%)</i>	82
QUICKER TURNAROUND TIMES.....	83
FAVORABLE ECONOMIES OF SCALE.....	83

EMERGENCE OF ATTRACTIVE OUTSOURCING DESTINATIONS.....	83
FAVORABLE SUPPLY CHAIN	84
MARKETS FOR OSPT SERVICES	84
END USER DEVICE APPLICATION MARKET BY SECTOR	84
<i>TABLE 22 GLOBAL SHARE FORECAST OF OSPT SALES, BY SECTOR, THROUGH 2011 (%)</i>	85
<i>FIGURE 17 GLOBAL SHARE FORECAST OF OSPT SALES, BY SECTOR, 2004-2011 (%)</i>	85
Application Market Analysis—Telecommunications	86
Application Market Analysis—Consumer Electronics.....	87
Application Market Analysis—PC	87
Regional Markets.....	88
<i>TABLE 23 GLOBAL MARKET SHARE FORECAST FOR OSPT SALES, BY REGION, THROUGH 2011 (%)</i>	88
<i>FIGURE 18 GLOBAL MARKET SHARE FOR OSPT SALES, BY REGION, 2004-2011 (%)</i>	89
Regional Market Analysis—APAC	89
South East Asian Region	89
China	89
India	90
Regional Market Analysis—Americas	90
Regional Market Analysis—EMEA	90
DRIVERS.....	91
PORTABILITY AND MINIATURIZATION OF DEVICES.....	91
<i>TABLE 24 CAGR COMPARISON—OSPT SALES VERSUS OSPT TELECOMMUNICATIONS SALES, THROUGH 2011</i>	92
<i>FIGURE 19 CAGR COMPARISON—OSPT SALES VERSUS OSPT TELECOMMUNICATIONS SALES, 2006-2011 (CAGR%)</i>	92
SHRINKING TURNAROUND TIMES	93
EMERGENCE OF THE APAC REGION	93
<i>TABLE 25 CAGR COMPARISON—OSPT SALES VERSUS OSPT APAC SALES THROUGH 2011 (CAGR%)</i>	93
<i>TABLE 25 (CONTINUED)</i>	94
<i>FIGURE 20 CAGR COMPARISON—OSPT SALES VERSUS OSPT APAC SALES, 2006-2011 (CAGR%)</i>	94
COST-EFFECTIVENESS OF ADVANCED PACKAGING SOLUTIONS	95
ASIC	95
SoC	95
Advantages of SiP and MCM	96
<i>TABLE 26 COMPARISON OF SALES OF ASIC, SOC, MCM AND SIP, THROUGH 2011 (\$ BILLIONS)</i>	96

<i>FIGURE 21 COMPARISON OF CAGRS OF ASIC, SOC, MCM AND SIP</i>	
(CAGR%).....	97
STANDARDS BODIES AND ROLE OF INDUSTRY CONSORTIA	97
HIGH DENSITY PACKAGING USER GROUP (HDPUG).....	97
INTERNATIONAL ELECTRONICS MANUFACTURING	
INITIATIVE (INEMI).....	98
JEDEC SOLID STATE TECHNOLOGY ASSOCIATION	
(FORMERLY JOINT ELECTRON DEVICE ENGINEERING	
COUNCIL).....	99
Jedec Solid State ...(Continued)	100
Microelectronics Packaging and Test Engineering Council	
(MEPTEC)	101
REGULATORY CONDITIONS	101
U.S. REGULATIONS	101
ASIAN REGULATIONS	101
WASTE FROM ELECTRICAL AND ELECTRONIC	
EQUIPMENT (WEEE) DIRECTIVE	101
RESTRICTION ON HAZARDOUS SUBSTANCES (ROHS)	102
CHALLENGES	102
IP RELATED DISPUTES	102
IP Related Disputes (Continued)	103
CHALLENGES POSED BY REGULATIONS	104
Revamp of the Supply Chain.....	104
<i>FIGURE 22 TEMPERATURE PROFILE OF EUTECTIC AND PB-FREE</i>	
<i>SOLDERS</i>	105
Semiconductor Company Strategies	105
Backward Compatibility	106
Wafer Bumping Challenges.....	106
<i>FIGURE 23 "LEAD FREE" SEAL</i>	107
Tin Whiskers.....	107
CASE STUDY—NATIONAL SEMICONDUCTOR	108
Case Study—National Semiconductor (Continued)	109
Case Study—National Semiconductor (Continued)	110
STAKEHOLDER DETAILS	111
CRITERIA FOR STAKEHOLDER CLASSIFICATION	111
CRITICAL REASONS FOR INDIVIDUAL STAKEHOLDER	
SELECTION	111
CRITICAL REASONS FOR INDIVIDUAL...(CONTINUED).....	112
CRITICAL REASONS FOR INDIVIDUAL...(CONTINUED).....	113
CRITICAL REASONS FOR INDIVIDUAL...(CONTINUED).....	114
CRITICAL REASONS FOR INDIVIDUAL...(CONTINUED).....	115
STAKEHOLDER CLASSIFICATION SUMMARY	116
<i>TABLE 27 SUMMARY OF SUPPLIERS AND THEIR PRINCIPAL</i>	
<i>ACTIVITIES</i>	116

<i>TABLE 27 (CONTINUED)</i>	117
STAKEHOLDER Profiles	117
ADVANCED INTERCONNECTIONS	118
Introduction	118
Packaging and Testing Function Value Additions.....	118
ADVANCED SEMICONDUCTOR ENGINEERING (ASE)	119
Introduction	119
Packaging and Testing Function Value Additions.....	120
Customers	121
Financial Performance	121
AMKOR TECHNOLOGIES, INC.	121
Introduction	121
Packaging and Testing Function Value Additions.....	122
Packaging and ... (Continued).....	123
Customers	124
Locations of Operations.....	124
Financial Performance	124
ANSOFT CORP.	124
Introduction	124
Packaging and Testing Function Value Additions.....	124
Packaging and Testing ... (Continued)	125
Customers	126
Financial Performance	126
ASAT HOLDINGS.....	126
Introduction	127
Packaging and Testing Function Value Additions.....	127
Customers	128
Locations of Operations.....	128
Financial Performance	128
BRIDGE SEMICONDUCTOR.....	128
Introduction	128
Packaging and Testing Function Value Additions.....	129
CADENCE DESIGN SYSTEMS.....	130
Introduction	130
Packaging and Testing Function Value Additions.....	130
Locations of Operations.....	131
Financial Performance	131
CHARTERED SEMICONDUCTOR MANUFACTURING.....	132
Introduction	132
Packaging and Testing Function Value Additions.....	132
Customers	133
Locations of Operations.....	133
Financial Performance	133
CHIPMOS TECHNOLOGIES	133

Introduction	133
Packaging and Testing Function Value Additions.....	133
Customers	134
Locations of Operations.....	135
Financial Performance	135
FLIPCHIP INTERNATIONAL (FCI)	135
Introduction	135
Packaging and Testing Function Value Additions.....	135
Packaging and Testing ... (Continued)	136
Customers	137
Locations of Operations.....	137
Financial Performance	137
FUJITSU, LTD.....	137
Introduction	137
Packaging and Testing Function Value Additions.....	137
Locations of Operations.....	138
Financial Performance	138
IBM	139
Introduction	139
Packaging and Testing Function Value Additions.....	139
Financial Performance	140
INTEL.....	140
Packaging and Testing Function Value Additions.....	140
Financial Performance	141
MICRON TECHNOLOGY, INC.....	141
Introduction	141
Packaging and Testing Function Value Additions.....	141
Financial Performance	142
M-SYSTEMS (ACQUIRED BY SANDISK).....	142
Introduction	142
Packaging and Testing Function Value Additions.....	143
Financial Performance	143
NATIONAL SEMICONDUCTOR CORP.	143
Introduction	143
Packaging and Testing Function Value Additions.....	144
Locations of Operations.....	145
Financial Performance	145
NEOCONIX, INC.	145
Introduction	145
Packaging and Testing Function Value Additions.....	145
Locations of Operations.....	146
PSI Technologies Holdings	147
Introduction	147
Packaging and Testing Function Value Additions.....	147

Customers	148
Locations of Operations.....	148
Financial Performance	148
SAMSUNG SEMICONDUCTOR, INC.....	148
Introduction	148
Packaging and Testing Function Value Additions.....	149
Locations of Operations.....	150
Financial Performance	150
SILICONWARE PRECISION INDUSTRIES (SPIL)	150
Introduction	150
Packaging and Testing Function Value Additions.....	150
Packaging And Testing ... (Continued).....	151
Locations of Operations.....	152
Financial Performance	152
STMICROELECTRONICS (ST)	152
Introduction	152
Packaging and Testing Function Value Additions.....	153
Customers	153
Locations of Operations.....	154
Financial Performance	154
STAKTEK.....	154
Introduction	154
Packaging and Testing Function Value Additions.....	154
Customers	155
Locations of Operations.....	155
Financial Performance	155
STATS CHIPPAC	155
Introduction	155
Packaging and Testing Function Value Additions.....	155
Packaging and Testing ... (Continued)	156
Packaging and ... (Continued).....	157
Financial Performance	158
SYNOPSYS.....	159
Introduction	159
Packaging and Testing Function Value Additions.....	159
Customers	160
Financial Performance	160
TESSERA TECHNOLOGIES	160
Introduction	160
Packaging and Testing Function Value Additions.....	160
Packaging and ... (Continued).....	161
<i>FIGURE 24 WLP FOR IMAGE SENSORS</i>	<i>162</i>
Customers	163
Financial Performance	163

TOSHIBA AMERICA ELECTRIC COMPONENTS AND SEMICONDUCTORS (TAEC).....	163
Introduction	163
Packaging and Testing Function Value Additions.....	164
Financial Performance	165
TAIWAN SEMICONDUCTOR MANUFACTURING COMPANY (TSMC)	165
Introduction	165
Packaging and Testing Function Value Additions.....	165
Locations of Operations.....	166
Financial Performance	166
UNITED MICROELECTRONICS CORP.....	166
Introduction	166
Packaging and Testing Function Value Additions.....	166
Financial Performance	167
XRADIA	167
Introduction	167
Packaging and Testing Function Value Additions.....	167
Financial Performance	168
U.S. PATENT ANALYSIS.....	169
INTRODUCTION	169
GENERAL TRENDS.....	169
<i>TABLE 28 ADVANCED ELECTRONIC PACKAGING TECHNIQUES: U.S. PATENT TRENDS, 1976–2006</i>	170
TRENDS BY COUNTRY	170
<i>FIGURE 25 SHARES OF U.S. PATENTS RELATED TO ADVANCED ELECTRONIC PACKAGING TECHNIQUES, BY COUNTRY, 1976–2006</i>	170
<i>FIGURE 25 (CONTINUED)</i>	171
TRENDS BY ASSIGNEE	171
<i>TABLE 29 ASSIGNEES OF 10 OR MORE U.S. PATENTS RELATED TO ADVANCED ELECTRONIC PACKAGING, 1976–2006</i>	172
TRENDS BY CATEGORY	173
<i>TABLE 30 CLASSIFICATION OF U.S. PATENTS RELATED TO ADVANCED ELECTRONIC PACKAGING BY CATEGORY, 1976–2006</i>	173