

# HAPTIC TECHNOLOGY: APPLICATIONS AND GLOBAL MARKETS



IAS101A  
May 2015

Shalini R  
*Project Analyst*

ISBN: 1-62296-087-4



**BCC Research**  
49 Walnut Park, Building 2  
Wellesley, MA 02481 USA  
866-285-7215 (toll-free within the USA),  
or (+1) 781-489-7301  
[www.bccresearch.com](http://www.bccresearch.com)  
[information@bccresearch.com](mailto:information@bccresearch.com)

**TABLE OF CONTENTS**

<b>TOPIC</b>	<b>PAGE NO.</b>
CHAPTER 1 INTRODUCTION	2
STUDY GOALS AND OBJECTIVES	2
REASONS FOR DOING THE STUDY	3
SCOPE OF THE REPORT	4
INTENDED AUDIENCE	5
METHODOLOGY	6
INFORMATION SOURCES	6
ANALYST'S CREDENTIALS	6
RELATED BCC RESEARCH REPORTS	6
BCC RESEARCH WEBSITE	6
DISCLAIMER	7
CHAPTER 2 EXECUTIVE SUMMARY	9
<i>SUMMARY TABLE GLOBAL HAPTIC TECHNOLOGY ACTUATOR MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)</i>	9
<i>SUMMARY FIGURE GLOBAL HAPTIC TECHNOLOGY ACTUATOR MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)</i>	9
CHAPTER 3 HAPTIC TECHNOLOGIES AND MARKET OVERVIEW	14
DEFINITION OF HAPTICS	14
APPLICATIONS OF HAPTICS	14
INTRODUCTION	14
MARKET OVERVIEW	14
<i>TABLE 1 GLOBAL MARKET FOR HAPTIC TECHNOLOGY DRIVERS BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)</i>	15
<i>TABLE 2 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES BY END-USE APPLICATION, THROUGH 2020 (MILLION UNITS)</i>	16
QUALITATIVE ANALYSIS	17
ACTUATORS AND DRIVERS	18
INTRODUCTION	18
TOUCH SCREENS-THE CATALYSTS FOR HAPTICS	19
Eccentric Rotating Motors (ERM)	19
Linear Resonant Actuators (LRA)	20
Piezoelectric Actuators	21
Electroactive Polymers (EAPS)	21
Others, Including Fluid, Electric-Field and Acoustic Wave-Based	22
Fluids	22
Electric Field	22
Sound	22
HAPTIC DRIVERS	22
MARKET OVERVIEW	23
<i>TABLE 3 GLOBAL HAPTIC TECHNOLOGY ACTUATORS MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	23
<i>TABLE 4 GLOBAL HAPTIC TECHNOLOGY DRIVERS MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	24
<i>TABLE 5 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)</i>	25

<b>TOPIC</b>	<b>PAGE NO.</b>
Analysis of the Larger Picture	26
Explaining the Rise in ASP	26
<b>GEOGRAPHICAL REGIONS</b>	27
<b>INTRODUCTION TO THE REGIONAL MARKETS</b>	27
The Americas	27
EMEA	27
APAC	28
<b>MARKET OVERVIEW</b>	28
<i>TABLE 6 GLOBAL HAPTIC TECHNOLOGY ACTUATORS MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	29
<i>TABLE 7 GLOBAL HAPTIC TECHNOLOGY DRIVERS BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	29
<i>TABLE 8 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES BY REGION, THROUGH 2020 (MILLION UNITS)</i>	30
Qualitative Analysis	31
<b>IN DEPTH-ACTUATION TECHNOLOGIES</b>	31
<b>ERM</b>	31
Quantitative Forecasts	31
<i>TABLE 9 GLOBAL ERM HAPTIC TECHNOLOGY ACTUATORS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)</i>	32
<i>TABLE 10 GLOBAL ERM HAPTIC TECHNOLOGY DRIVERS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)</i>	33
<i>TABLE 11 GLOBAL SHIPMENTS OF ERM HAPTIC TECHNOLOGY-ENABLED DEVICES BY END-USE APPLICATION, THROUGH 2020 (MILLION UNITS)</i>	34
Qualitative Analysis	36
<b>LRA</b>	36
<i>TABLE 12 GLOBAL LRA HAPTIC TECHNOLOGY ACTUATORS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)</i>	36
<i>TABLE 13 GLOBAL LRA HAPTIC TECHNOLOGY DRIVERS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)</i>	37
<i>TABLE 14 GLOBAL SHIPMENTS OF LRA HAPTIC TECHNOLOGY-ENABLED DEVICES BY END-USE APPLICATION, THROUGH 2020 (MILLION UNITS)</i>	39
Qualitative Analysis	40
<b>PIEZOELECTRIC ACTUATORS</b>	40
<i>TABLE 15 GLOBAL PIEZOELECTRIC HAPTIC TECHNOLOGY ACTUATORS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)</i>	40
<i>TABLE 16 GLOBAL PIEZOELECTRIC HAPTIC TECHNOLOGY DRIVERS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)</i>	42
<i>TABLE 17 GLOBAL SHIPMENTS OF PIEZOELECTRIC HAPTIC TECHNOLOGY-ENABLED DEVICES BY END-USE APPLICATION, THROUGH 2020 (MILLION UNITS)</i>	43
Qualitative Analysis	44
<b>EAP</b>	44
<i>TABLE 18 GLOBAL EAP HAPTIC TECHNOLOGY ACTUATORS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)</i>	44
<i>TABLE 19 GLOBAL EAP HAPTIC TECHNOLOGY DRIVERS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)</i>	46
<i>TABLE 20 GLOBAL SHIPMENTS OF EAP HAPTIC TECHNOLOGY-ENABLED DEVICES BY END-USE APPLICATION, THROUGH 2020 (MILLION UNITS)</i>	47
Qualitative Analysis	48
<b>OTHERS, INCLUDING FLUID, ELECTRIC-FIELD AND ACOUSTIC WAVE-BASED</b>	48

<b>TOPIC</b>	<b>PAGE NO.</b>
<i>TABLE 21 GLOBAL OTHERS MARKET, INCLUDING FLUID, ELECTRIC-FIELD AND ACOUSTIC WAVE-BASED HAPTIC TECHNOLOGY ACTUATORS, BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)</i>	49
<i>TABLE 22 GLOBAL OTHERS MARKET, INCLUDING FLUID, ELECTRIC-FIELD AND ACOUSTIC WAVE-BASED HAPTIC TECHNOLOGY DRIVERS, BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)</i>	50
<i>TABLE 23 GLOBAL SHIPMENTS OF OTHERS DEVICES, INCLUDING FLUID, ELECTRIC-FIELD AND ACOUSTIC WAVE-BASED HAPTIC TECHNOLOGY-ENABLED BY END-USE APPLICATION, THROUGH 2020 (MILLION UNITS)</i>	51
Qualitative Analysis	52
<b>CHAPTER 4 GLOBAL MARKETS FOR END-USE APPLICATIONS OF HAPTIC TECHNOLOGY ACTUATORS AND DRIVERS</b>	54
AUTOMOTIVE AND TRANSPORTATION	54
APPLICATION SNAPSHOT	54
BREAKDOWN BY HAPTIC TECHNOLOGY	54
<i>TABLE 24 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE AUTOMOTIVE AND TRANSPORTATION END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	55
<i>TABLE 25 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE AUTOMOTIVE AND TRANSPORTATION MARKET END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	56
<i>TABLE 26 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE AUTOMOTIVE AND TRANSPORTATION END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)</i>	57
REGIONAL ANALYSIS	58
<i>TABLE 27 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE AUTOMOTIVE AND TRANSPORTATION END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	58
<i>TABLE 28 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE AUTOMOTIVE AND TRANSPORTATION END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	58
<i>TABLE 29 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE AUTOMOTIVE AND TRANSPORTATION END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)</i>	59
CONSUMER ELECTRONICS, ENTERTAINMENT AND COMPUTING	60
APPLICATION SNAPSHOT	60
BREAKDOWN BY HAPTIC TECHNOLOGY	61
<i>TABLE 30 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE CONSUMER ELECTRONICS, ENTERTAINMENT AND COMPUTING END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	61
<i>TABLE 31 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE CONSUMER ELECTRONICS, ENTERTAINMENT AND COMPUTING END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	62
<i>TABLE 32 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE CONSUMER ELECTRONICS, ENTERTAINMENT AND COMPUTING END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)</i>	63
REGIONAL ANALYSIS	64
<i>TABLE 33 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE CONSUMER ELECTRONICS, ENTERTAINMENT AND COMPUTING END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	64

<b>TOPIC</b>	<b>PAGE NO.</b>
<i>TABLE 34 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE CONSUMER ELECTRONICS, ENTERTAINMENT AND COMPUTING END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	65
<i>TABLE 35 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE CONSUMER ELECTRONICS, ENTERTAINMENT AND COMPUTING END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)</i>	65
EDUCATION	66
APPLICATION SNAPSHOT	66
BREAKDOWN BY HAPTIC TECHNOLOGY	66
<i>TABLE 36 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE EDUCATION END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	66
<i>TABLE 37 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE EDUCATION END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	68
<i>TABLE 38 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE EDUCATION END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)</i>	69
REGIONAL ANALYSIS	69
<i>TABLE 39 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE EDUCATION END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	70
<i>TABLE 40 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE EDUCATION END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	70
<i>TABLE 41 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE EDUCATION END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)</i>	71
GAMING	72
APPLICATION SNAPSHOT	72
BREAKDOWN BY HAPTIC TECHNOLOGY	72
<i>TABLE 42 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE GAMING END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	72
<i>TABLE 43 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE GAMING END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	73
<i>TABLE 44 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE GAMING END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)</i>	74
REGIONAL ANALYSIS	75
<i>TABLE 45 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE GAMING END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	75
<i>TABLE 46 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE GAMING END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	76
<i>TABLE 47 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE GAMING END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)</i>	77
GOVERNMENT AND DEFENSE	77
APPLICATION SNAPSHOT	77
BREAKDOWN BY HAPTIC TECHNOLOGY	78
<i>TABLE 48 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE GOVERNMENT AND DEFENSE END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	78
<i>TABLE 49 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE GOVERNMENT AND DEFENSE END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	79

<b>TOPIC</b>	<b>PAGE NO.</b>
<i>TABLE 50 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE GOVERNMENT AND DEFENSE END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)</i>	80
REGIONAL ANALYSIS	81
<i>TABLE 51 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE GOVERNMENT AND DEFENSE END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	81
<i>TABLE 52 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE GOVERNMENT AND DEFENSE END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	81
<i>TABLE 53 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE GOVERNMENT AND DEFENSE END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)</i>	82
HEALTHCARE	83
APPLICATION SNAPSHOT	83
BREAKDOWN BY HAPTIC TECHNOLOGY	84
<i>TABLE 54 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE HEALTHCARE END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	84
<i>TABLE 55 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE HEALTHCARE END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	85
<i>TABLE 56 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE HEALTHCARE END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)</i>	86
REGIONAL ANALYSIS	87
<i>TABLE 57 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE HEALTHCARE END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	87
<i>TABLE 58 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE HEALTHCARE END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	87
<i>TABLE 59 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE HEALTHCARE END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)</i>	88
INDUSTRY, ENERGY AND OUTDOORS	89
APPLICATION SNAPSHOT	89
BREAKDOWN BY HAPTIC TECHNOLOGY	89
<i>TABLE 60 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE INDUSTRY, ENERGY AND OUTDOORS END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	90
<i>TABLE 61 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE INDUSTRY, ENERGY AND OUTDOORS END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	91
<i>TABLE 62 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE INDUSTRY, ENERGY AND OUTDOORS END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)</i>	92
REGIONAL ANALYSIS	92
<i>TABLE 63 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE INDUSTRY, ENERGY AND OUTDOORS END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	93
<i>TABLE 64 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE INDUSTRY, ENERGY AND OUTDOORS END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	93
<i>TABLE 65 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE INDUSTRY, ENERGY AND OUTDOORS END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)</i>	94

<b>TOPIC</b>	<b>PAGE NO.</b>
<i>MOBILE COMPUTING AND PORTABLE DEVICES</i>	95
APPLICATION SNAPSHOT	95
BREAKDOWN BY HAPTIC TECHNOLOGY	95
<i>TABLE 66 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE MOBILE COMPUTING AND PORTABLE DEVICES END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	96
<i>TABLE 67 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE MOBILE COMPUTING AND PORTABLE DEVICES END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)</i>	97
<i>TABLE 68 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE MOBILE COMPUTING AND PORTABLE END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)</i>	98
REGIONAL ANALYSIS	98
<i>TABLE 69 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE MOBILE COMPUTING AND PORTABLE DEVICES END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	99
<i>TABLE 70 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE MOBILE COMPUTING AND PORTABLE DEVICES END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)</i>	99
<i>TABLE 71 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE MOBILE COMPUTING AND PORTABLE END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)</i>	100
CHAPTER 5 TAXONOMY OF THE VENDOR LANDSCAPE	103
ERM/LRA COMPONENT MAKERS	103
PIEZOELECTRIC ACTUATOR EXPERTS	104
EAP SPECIALISTS	104
NICHE ACTUATION TECHNOLOGY DEVELOPERS	104
DISPLAY, TOUCH SCREEN AND INPUT INTERFACE MANUFACTURERS	105
SEMICONDUCTOR DEVICE MAKERS	105
OEMS	105
IP OWNERS	105
KEY COMPANY PROFILES	106
3D SYSTEMS	106
INTRODUCTION	106
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	106
ANALYSIS AND PROSPECTS	106
3M	107
INTRODUCTION	107
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	107
ANALYSIS AND PROSPECTS	107
AAC TECHNOLOGIES HOLDINGS INC.	107
INTRODUCTION	108
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	108
ANALYSIS AND PROSPECTS	108
APPLE	108
INTRODUCTION	108
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	108
ANALYSIS AND PROSPECTS	109
ARTIFICIAL MUSCLE	109

<b>TOPIC</b>	<b>PAGE NO.</b>
INTRODUCTION	109
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	109
ANALYSIS AND PROSPECTS	109
<b>ATMEL</b>	110
INTRODUCTION	110
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	110
ANALYSIS AND PROSPECTS	110
<b>BAYER</b>	110
INTRODUCTION	111
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	111
ANALYSIS AND PROSPECTS	111
<b>BUJEON</b>	111
INTRODUCTION	111
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	111
ANALYSIS AND PROSPECTS	112
<b>NIHON CERATEC</b>	112
INTRODUCTION	112
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	112
ANALYSIS AND PROSPECTS	113
<b>CYPRESS</b>	113
INTRODUCTION	113
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	113
ANALYSIS AND PROSPECTS	113
<b>DAESUNG ELECTRIC</b>	114
INTRODUCTION	114
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	114
ANALYSIS AND PROSPECTS	114
<b>DENSITRON TECHNOLOGIES</b>	114
INTRODUCTION	114
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	115
ANALYSIS AND PROSPECTS	115
<b>FUJITSU</b>	115
INTRODUCTION	115
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	115
ANALYSIS AND PROSPECTS	115
<b>GESTURETEK</b>	116
INTRODUCTION	116
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	116
ANALYSIS AND PROSPECTS	116
<b>HAPTION S.A.</b>	116
INTRODUCTION	116
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	117
ANALYSIS AND PROSPECTS	117
<b>HOKURIKU ELECTRIC</b>	117
INTRODUCTION	117
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	117
ANALYSIS AND PROSPECTS	118



<b>TOPIC</b>	<b>PAGE NO.</b>
IMMERSION	118
INTRODUCTION	118
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	118
SDK FOR APPLICATION DEVELOPERS	119
ANALYSIS AND PROSPECTS	119
JAHWA ELECTRONICS	119
INTRODUCTION	119
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	119
ANALYSIS AND PROSPECTS	120
JOHNSON ELECTRIC	120
INTRODUCTION	120
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	120
ANALYSIS AND PROSPECTS	120
KONGHONG	121
INTRODUCTION	121
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	121
ANALYSIS AND PROSPECTS	121
KOTL-JINLONG	121
INTRODUCTION	121
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	122
ANALYSIS AND PROSPECTS	122
MAXIM INTEGRATED	122
INTRODUCTION	122
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	122
ANALYSIS AND PROSPECTS	123
MICROCHIP TECHNOLOGY	123
INTRODUCTION	123
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	123
ANALYSIS AND PROSPECTS	123
MICROSOFT	123
INTRODUCTION	124
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	124
ANALYSIS AND PROSPECTS	124
MINEBEA	124
INTRODUCTION	124
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	124
ANALYSIS AND PROSPECTS	125
NEC	125
INTRODUCTION	125
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	125
ANALYSIS AND PROSPECTS	125
NIDEC COPAL CORP	126
INTRODUCTION	126
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	126
ANALYSIS AND PROSPECTS	126
REDUX LABS	126
INTRODUCTION	126

<b>TOPIC</b>	<b>PAGE NO.</b>
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	127
ANALYSIS AND PROSPECTS	127
SAMSUNG	127
INTRODUCTION	127
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	127
ANALYSIS AND PROSPECTS	128
SENSEG	128
INTRODUCTION	128
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	128
ANALYSIS AND PROSPECTS	128
SMK CORP.	129
INTRODUCTION	129
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	129
ANALYSIS AND PROSPECTS	129
SYNAPTICS	129
INTRODUCTION	129
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	130
ANALYSIS AND PROSPECTS	130
TACTUS TECHNOLOGY	130
INTRODUCTION	130
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	130
ANALYSIS AND PROSPECTS	131
TDK	131
INTRODUCTION	131
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	131
ANALYSIS AND PROSPECTS	131
TI	132
INTRODUCTION	132
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	132
ANALYSIS AND PROSPECTS	132
YEIL ELECTRONICS	132
INTRODUCTION	133
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	133
ANALYSIS AND PROSPECTS	133
YOOSUNG PRECISION	133
INTRODUCTION	133
HAPTIC TECHNOLOGY SOLUTIONS OFFERED	133
ANALYSIS AND PROSPECTS	134
CHAPTER 6 U.S. PATENT ANALYSIS	136
INTRODUCTION	136
PATENT CATEGORIES	136
ACTUATION OUTPUT FEEDBACK MANAGEMENT AND MANIPULATION	136
AUTOMOTIVE, TRANSPORTATION, RAILWAYS, WATERWAYS, AVAIATION AND SPACE APPLICATIONS	137
EAP ACTUATOR TECHNOLOGY AND COMPONENT DESIGN	138
ENTERTAINMENT, CONSUMER ELECTRONICS, TELECOMMUNICATIONS AND MULTIMEDIA APPLICATION	138

<b>TOPIC</b>	<b>PAGE NO.</b>
ERM ACTUATOR TECHNOLOGY AND COMPONENT DESIGN	139
GAMING, MODELING AND VIRTUAL REALITY APPLICATIONS	139
HEALTHCARE, HYGIENE, PERSONAL CARE AND MEDICAL DEVICE APPLICATION	140
INTEGRATED SENSING AND ACTUATION MECHANISM MANAGEMENT	141
MECHANISM FOR COLLECTION, CALIBRATION AND INTERPRETATION OF USER INPUTS	141
MOBILE COMPUTING AND NAVIGATION APPLICATION	142
OTHER ADVANCED ACTUATOR TECHNOLOGY AND COMPONENT DESIGN	142
PERSONAL COMPUTER AND SERVER SOFTWARE AND PERIPHERALS APPLICATION	142
PIEZOELECTRIC ACTUATOR TECHNOLOGY AND COMPONENT DESIGN	143
ROBOTIC AND OTHER INDUSTRIAL APPLICATION	143
VIBRATION MECHANISM LOCALIZATION, DISTRIBUTION, INTENSITY AND PATTERN MANAGEMENT	143
<i>TABLE 72 CLASSIFICATION OF U.S. PATENTS RELATED TO HAPTIC TECHNOLOGIES BY CATEGORY, 1976-MARCH 2015</i>	144
TRENDS BY YEAR	145
<i>TABLE 73 U.S. HAPTIC TECHNOLOGIES PATENT TRENDS BY YEAR, 1976-MARCH 2015</i>	145
TRENDS BY COUNTRY	146
<i>TABLE 74 SHARES OF U.S. PATENTS RELATED TO HAPTIC TECHNOLOGIES BY COUNTRY, 1976-MARCH 2015</i>	146
TRENDS BY ASSIGNEE	147
<i>TABLE 75 ASSIGNEES OF SIX OR MORE U.S. PATENTS RELATED TO HAPTIC TECHNOLOGIES, 1976-MARCH 2015</i>	147
<i>TABLE 76 LIST OF ASSIGNEES OF U.S. PATENTS RELATED TO HAPTIC TECHNOLOGIES, 1976-MARCH 2015</i>	154

**LIST OF TABLES**

<b>TABLE HEADING</b>	<b>PAGE NO.</b>
SUMMARY TABLE GLOBAL HAPTIC TECHNOLOGY ACTUATOR MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)	9
TABLE 1 GLOBAL MARKET FOR HAPTIC TECHNOLOGY DRIVERS BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)	15
TABLE 2 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES BY END-USE APPLICATION, THROUGH 2020 (MILLION UNITS)	16
TABLE 3 GLOBAL HAPTIC TECHNOLOGY ACTUATORS MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	23
TABLE 4 GLOBAL HAPTIC TECHNOLOGY DRIVERS MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	24
TABLE 5 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)	25
TABLE 6 GLOBAL HAPTIC TECHNOLOGY ACTUATORS MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	29
TABLE 7 GLOBAL HAPTIC TECHNOLOGY DRIVERS BY REGION, THROUGH 2020 (\$ MILLIONS)	29
TABLE 8 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES BY REGION, THROUGH 2020 (MILLION UNITS)	30
TABLE 9 GLOBAL ERM HAPTIC TECHNOLOGY ACTUATORS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)	32
TABLE 10 GLOBAL ERM HAPTIC TECHNOLOGY DRIVERS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)	33
TABLE 11 GLOBAL SHIPMENTS OF ERM HAPTIC TECHNOLOGY-ENABLED DEVICES BY END-USE APPLICATION, THROUGH 2020 (MILLION UNITS)	34
TABLE 12 GLOBAL LRA HAPTIC TECHNOLOGY ACTUATORS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)	36
TABLE 13 GLOBAL LRA HAPTIC TECHNOLOGY DRIVERS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)	37
TABLE 14 GLOBAL SHIPMENTS OF LRA HAPTIC TECHNOLOGY-ENABLED DEVICES BY END-USE APPLICATION, THROUGH 2020 (MILLION UNITS)	39
TABLE 15 GLOBAL PIEZOELECTRIC HAPTIC TECHNOLOGY ACTUATORS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)	40
TABLE 16 GLOBAL PIEZOELECTRIC HAPTIC TECHNOLOGY DRIVERS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)	42
TABLE 17 GLOBAL SHIPMENTS OF PIEZOELECTRIC HAPTIC TECHNOLOGY-ENABLED DEVICES BY END-USE APPLICATION, THROUGH 2020 (MILLION UNITS)	43
TABLE 18 GLOBAL EAP HAPTIC TECHNOLOGY ACTUATORS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)	44
TABLE 19 GLOBAL EAP HAPTIC TECHNOLOGY DRIVERS MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)	46
TABLE 20 GLOBAL SHIPMENTS OF EAP HAPTIC TECHNOLOGY-ENABLED DEVICES BY END-USE APPLICATION, THROUGH 2020 (MILLION UNITS)	47
TABLE 21 GLOBAL OTHERS MARKET, INCLUDING FLUID, ELECTRIC-FIELD AND ACOUSTIC WAVE-BASED HAPTIC TECHNOLOGY ACTUATORS, BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)	49
TABLE 22 GLOBAL OTHERS MARKET, INCLUDING FLUID, ELECTRIC-FIELD AND ACOUSTIC WAVE-BASED HAPTIC TECHNOLOGY DRIVERS, BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)	50
TABLE 23 GLOBAL SHIPMENTS OF OTHERS DEVICES, INCLUDING FLUID, ELECTRIC-FIELD AND ACOUSTIC WAVE-BASED HAPTIC TECHNOLOGY-ENABLED BY END-USE APPLICATION, THROUGH 2020 (MILLION UNITS)	51

<b>TABLE HEADING</b>	<b>PAGE NO.</b>
TABLE 24 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE AUTOMOTIVE AND TRANSPORTATION END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	55
TABLE 25 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE AUTOMOTIVE AND TRANSPORTATION MARKET END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	56
TABLE 26 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE AUTOMOTIVE AND TRANSPORTATION END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)	57
TABLE 27 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE AUTOMOTIVE AND TRANSPORTATION END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	58
TABLE 28 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE AUTOMOTIVE AND TRANSPORTATION END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	58
TABLE 29 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE AUTOMOTIVE AND TRANSPORTATION END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)	59
TABLE 30 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE CONSUMER ELECTRONICS, ENTERTAINMENT AND COMPUTING END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	61
TABLE 31 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE CONSUMER ELECTRONICS, ENTERTAINMENT AND COMPUTING END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	62
TABLE 32 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE CONSUMER ELECTRONICS, ENTERTAINMENT AND COMPUTING END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)	63
TABLE 33 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE CONSUMER ELECTRONICS, ENTERTAINMENT AND COMPUTING END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	64
TABLE 34 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE CONSUMER ELECTRONICS, ENTERTAINMENT AND COMPUTING END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	65
TABLE 35 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE CONSUMER ELECTRONICS, ENTERTAINMENT AND COMPUTING END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)	65
TABLE 36 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE EDUCATION END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	66
TABLE 37 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE EDUCATION END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	68
TABLE 38 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE EDUCATION END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)	69
TABLE 39 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE EDUCATION END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	70
TABLE 40 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE EDUCATION END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	70
TABLE 41 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE EDUCATION END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)	71
TABLE 42 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE GAMING END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	72
TABLE 43 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE GAMING END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	73

<b>TABLE HEADING</b>	<b>PAGE NO.</b>
TABLE 44 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE GAMING END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)	74
TABLE 45 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE GAMING END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	75
TABLE 46 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE GAMING END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	76
TABLE 47 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE GAMING END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)	77
TABLE 48 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE GOVERNMENT AND DEFENSE END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	78
TABLE 49 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE GOVERNMENT AND DEFENSE END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	79
TABLE 50 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE GOVERNMENT AND DEFENSE END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)	80
TABLE 51 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE GOVERNMENT AND DEFENSE END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	81
TABLE 52 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE GOVERNMENT AND DEFENSE END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	81
TABLE 53 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE GOVERNMENT AND DEFENSE END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)	82
TABLE 54 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE HEALTHCARE END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	84
TABLE 55 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE HEALTHCARE END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	85
TABLE 56 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE HEALTHCARE END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)	86
TABLE 57 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE HEALTHCARE END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	87
TABLE 58 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE HEALTHCARE END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	87
TABLE 59 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE HEALTHCARE END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)	88
TABLE 60 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE INDUSTRY, ENERGY AND OUTDOORS END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	90
TABLE 61 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE INDUSTRY, ENERGY AND OUTDOORS END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	91
TABLE 62 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE INDUSTRY, ENERGY AND OUTDOORS END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)	92
TABLE 63 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE INDUSTRY, ENERGY AND OUTDOORS END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	93
TABLE 64 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE INDUSTRY, ENERGY AND OUTDOORS END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	93

<b>TABLE HEADING</b>	<b>PAGE NO.</b>
TABLE 65 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE INDUSTRY, ENERGY AND OUTDOORS END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)	94
TABLE 66 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE MOBILE COMPUTING AND PORTABLE DEVICES END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	96
TABLE 67 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE MOBILE COMPUTING AND PORTABLE DEVICES END-USE APPLICATION MARKET BY HAPTIC TECHNOLOGY, THROUGH 2020 (\$ MILLIONS)	97
TABLE 68 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE MOBILE COMPUTING AND PORTABLE END-USE APPLICATIONS BY HAPTIC TECHNOLOGY, THROUGH 2020 (MILLION UNITS)	98
TABLE 69 GLOBAL HAPTIC TECHNOLOGY ACTUATORS TO THE MOBILE COMPUTING AND PORTABLE DEVICES END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	99
TABLE 70 GLOBAL HAPTIC TECHNOLOGY DRIVERS TO THE MOBILE COMPUTING AND PORTABLE DEVICES END-USE APPLICATION MARKET BY REGION, THROUGH 2020 (\$ MILLIONS)	99
TABLE 71 GLOBAL SHIPMENTS OF HAPTIC TECHNOLOGY-ENABLED DEVICES TO THE MOBILE COMPUTING AND PORTABLE END-USE APPLICATIONS BY REGION, THROUGH 2020 (MILLION UNITS)	100
TABLE 72 CLASSIFICATION OF U.S. PATENTS RELATED TO HAPTIC TECHNOLOGIES BY CATEGORY, 1976-MARCH 2015	144
TABLE 73 U.S. HAPTIC TECHNOLOGIES PATENT TRENDS BY YEAR, 1976-MARCH 2015	145
TABLE 74 SHARES OF U.S. PATENTS RELATED TO HAPTIC TECHNOLOGIES BY COUNTRY, 1976-MARCH 2015	146
TABLE 75 ASSIGNEES OF SIX OR MORE U.S. PATENTS RELATED TO HAPTIC TECHNOLOGIES, 1976-MARCH 2015	147
TABLE 76 LIST OF ASSIGNEES OF U.S. PATENTS RELATED TO HAPTIC TECHNOLOGIES, 1976-MARCH 2015	154

**LIST OF FIGURES**

<b>FIGURE TITLE</b>	<b>PAGE NO.</b>
SUMMARY FIGURE GLOBAL HAPTIC TECHNOLOGY ACTUATOR MARKET BY END-USE APPLICATION, THROUGH 2020 (\$ MILLIONS)	9