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SAMSUNG MEMORY

Jun, 2019

Investor Presentation
# SAMSUNG MEMORY BUSINESS REVIEW

#1 in Memory Worldwide Since 1993, Well Balanced DRAM/NAND Portfolio

<table>
<thead>
<tr>
<th>Year</th>
<th>DRAM Market Share</th>
<th>NAND Market Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>38%</td>
<td>41%</td>
</tr>
<tr>
<td>2014</td>
<td>42%</td>
<td>41%</td>
</tr>
<tr>
<td>2015</td>
<td>43%</td>
<td>41%</td>
</tr>
<tr>
<td>2016</td>
<td>43%</td>
<td>41%</td>
</tr>
<tr>
<td>2017</td>
<td>43%</td>
<td>41%</td>
</tr>
<tr>
<td>2018</td>
<td>43%</td>
<td>41%</td>
</tr>
</tbody>
</table>

Source: IDC '18 4Q

<table>
<thead>
<tr>
<th>Year</th>
<th>Market Share Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>$63B</td>
</tr>
<tr>
<td>2014</td>
<td>$64B</td>
</tr>
<tr>
<td>2015</td>
<td>$65B</td>
</tr>
<tr>
<td>2016</td>
<td>$66B</td>
</tr>
<tr>
<td>2017</td>
<td>$67B</td>
</tr>
<tr>
<td>2018</td>
<td>$67B</td>
</tr>
</tbody>
</table>

Source: IDC '18 4Q
MEMORY BIZ. PARADIGM SHIFT LED BY SAMSUNG

Samsung is Powering the Technologies that bring Innovation to Lifestyle

1990

Big Fluctuations

2000

1st Jump

2010

2nd Jump

2016

3rd Quantum Jump

Memory Revenue

1990

- iPod

- iPhone

- App Store

- Galaxy S

- Android Market

- China S/Phone

- Data Center

- AI

- Autonomous

1990

2000

2010

2016
CONTENTS

BUSINESS UPDATE

• MEMORY MARKET OPPORTUNITIES

SAMSUNG STRATEGY
GROWTH OF THE PUBLIC CLOUD
Explosive Growth of Unstructured Data

1st WAVE
Cloud Service Providers
2016

2nd WAVE
Com & Forbes Top100

3rd WAVE
5G
Telco Companies
2020

4th WAVE
Automotive Companies

THE FLOOD OF DATA
SMART CITY & AUTONOMOUS CAR FUELED BY 5G NETWORK

Huge Amounts of Data Generated by Hyper-connected Devices
MARKET OPPORTUNITY IN BIG DATA ANALYTICS

Demand Increase for High Density & Performance Memory to Enhance Computing Power

CLOUD
BIG DATA
Un-structured Data

DRAM
More Density

Structured Data

Accelerator + HBM
(GPGPU, FPGA, ASIC)

High Density / Performance

SSD
Low Latency;
Fast Response

Latency: Time Delay between input and output in a system
CONTINUOUS GROWTH OF MEMORY DEMAND
Memory Growth led by Server & Mobile Applications based on Big Data Ecosystem
SAMSUNG STRATEGY

Break-through Technology
- COST LEADERSHIP

Enhanced Solutions
- S/W & CONTROLLERS

Advanced Manufacturing
- EFFICIENCY & FLEXIBILITY
CONTINUOUS TECHNOLOGY SCALING
Thru Technology Evolution

FUTURE DRAM TECHNOLOGY

*DPT : Double Patterning Technology
*QPT : Quadruple Patterning Technology
*EUV : Extreme Ultra Violet

ADVANCED DESIGN TECH

Source: Samsung
PUSHING THE LIMITS OF V-NAND
Thru Innovative Layer Stacking Technology

Source: Samsung
UNIQUE CAPABILITIES FOR DIFFERENTIATED SOLUTIONS
Integrating Key Components to Deliver Value-added Solutions

ADVANCED PROCESS TECHNOLOGY
Wafer / Chip
- Smaller
- Higher Density
- Less Power Consumption
- Faster

ADVANCED PACKAGING TECHNOLOGY
Stacking / TSV
- Thinner
- Smaller
- No Performance Loss

VERTICAL INTEGRATION
Software & Logic (Controller)
- Customized
- Expandable
- Smarter
- Secure
SAMSUNG SOLUTIONS FOR THE 5G ERA
Enhanced Processing for Massive Data with Lower Latency & Less Power Consumption

FASTER DATA RATES WITH LOW POWER

TSV RDIMM, Z-SSD & NF1
- Low Latency*
- High Capacity
- Stable QoS

LPDDR5
- Higher Speed
- Lower Power Consumption
- Smaller Package

* Latency: Time Delay between input and output in a system
SAMSUNG SOLUTIONS FOR ARTIFICIAL INTELLIGENCE
Superlative Performance and High Reliability Using Less Energy

ENHANCED PERFORMANCE FOR DATA-INTENSIVE TASKS

8GB HBM2*
Fastest Performance
Energy Efficiency

32TB SAS SSD, 16TB NVMe SSD
Largest Density
Higher Reliability
Unparalleled Performance

* HBM: High Bandwidth Memory
SAMSUNG SOLUTIONS FOR AUTOMOTIVE INDUSTRY
Advanced Total Memory Solution for Automotive Applications & Connected Car

Dedicated Support for automotive
Diverse Memory Line-ups
Dedicated Manufacturing Line & Organization

Automotive eStorage
- High Density
- Temperature Notification
- Data Refresh

Automotive DRAM
- High Bandwidth
- Lower Power Consumption
- Higher Reliability

ELECTRIFIED
CONNECTED
AUTOMATED
APPLICATION-ORIENTED LINE MANAGEMENT
2-Track Strategy for Efficient Production & Capacity Allocation

ARTIFICIAL INTELLIGENCE

HIGH PERFORMANCE COMPUTING

PERFORMANCE
Leading Process Technology

FLEXIBILITY
DRAM/NAND Conversion

LONGEVITY
Proven Process Technology
EVOLUTION TO SMARTER FACTORY
Customer Value Improvement through High Productivity and Enhanced SCM

**SCM**
- Demand Fulfillment
- Inventory Management
- Lead Time Reduction
- Efficient Logistics

**PRODUCTIVITY**
- Automated Operation
- Seamless Quality Control
- Intelligent Planning
- Early Yield Improvement

**Big Data Based OPERATION**

* SCM: Supply Chain Management
QUALITY BY DESIGN
Exceed the Industry Standard and Expectation of AI & Automotive Customers

PREDICTIVE

ENHANCED QUALITY REQUIREMENT

1993 ISO9001
Quality Management System

1993 TL9000 QS9000
ICT/Auto Quality Requirement

2001 2002

2001 2002

2018
IATF16949
Automotive Supplemental Requirement

PREVENTIVE

PRESCRIPTIVE

COLLABORATIVE
Placing Memory at the Forefront of Future Innovation and Creative IT Life

Technology
Leading Technological Breakthroughs

Customers
Supporting Customers’ Future Innovation

Employees
Fostering Employees’ Creativity

Society
Enriching a New Way of Digital Life

http://www.samsung.com/semiconductor