Samsung System LSI Business

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The materials in this report include forward-looking statements which can generally be identified by phrases such as Samsung Electronics (SEC) or its management "believes," "expects," "anticipates," "foresees," "forecasts," "estimates" or other words or phrases of similar implications. Similarly, such statements that describe the company’s business strategy, outlook, objectives, plans, intentions or goals are also forward-looking statements. All such statements are subject to certain risks and uncertainties that could cause actual results to differ materially from those in the presentation files above.

For us, particular uncertainties which could adversely or positively affect our future results include:

- The behavior of financial markets including fluctuations in exchange rates, interest rates and commodity prices
- Strategic actions including dispositions and acquisitions
- Unanticipated dramatic developments in our major businesses including CE (Consumer Electronics), IM (IT & Mobile communications), DS (Device Solutions)
- Numerous other matters at the national and international levels which could affect our future results

These uncertainties may cause our actual results to be materially different from those expressed in this report.
System Semiconductor Industry

Samsung System LSI : Now

Looking Forward
Market of Mobile Device

### Smartphone

<table>
<thead>
<tr>
<th>Year</th>
<th>Premium</th>
<th>Mid + Low</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.3</td>
<td>0.5</td>
<td>0.8</td>
</tr>
<tr>
<td>2013</td>
<td>0.5</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>2014(E)</td>
<td>0.6</td>
<td>0.6</td>
<td>1.2</td>
</tr>
<tr>
<td>2015(E)</td>
<td>0.7</td>
<td>0.7</td>
<td>1.3</td>
</tr>
</tbody>
</table>

- **Premium:** 22% increase from 2012 to 2013, 9% increase from 2013 to 2014(E), 22% increase from 2014(E) to 2015(E).
- **Mid + Low:** 22% increase from 2012 to 2013, 9% increase from 2013 to 2014(E), 22% increase from 2014(E) to 2015(E).

**Source:** Gartner, Strategy Analytics, 2013 3Q

### Tablet

<table>
<thead>
<tr>
<th>Year</th>
<th>Premium</th>
<th>Mid + Low</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.07</td>
<td>0.05</td>
<td>0.1</td>
</tr>
<tr>
<td>2013</td>
<td>0.06</td>
<td>0.12</td>
<td>0.2</td>
</tr>
<tr>
<td>2014(E)</td>
<td>0.07</td>
<td>0.19</td>
<td>0.3</td>
</tr>
<tr>
<td>2015(E)</td>
<td>0.09</td>
<td>0.26</td>
<td>0.4</td>
</tr>
</tbody>
</table>

- **Premium:** 25% increase from 2012 to 2013, 25% increase from 2013 to 2014(E), 58% increase from 2014(E) to 2015(E).
- **Mid + Low:** 25% increase from 2012 to 2013, 25% increase from 2013 to 2014(E), 58% increase from 2014(E) to 2015(E).

**Source:** Gartner, 2013 3Q
Computing Power

- New applications require higher computing/bandwidth

Resolution

Single Camcording

1080p Video

Dual Camcording

Web browsing

Location Based Service

Voice Command
Display Trend

• Higher resolution

HD (1,280x720)

FHD (1,920x1,080)

WQHD (2,560x1,440)

UHD (3,840x2,160)

2011 2013 2015(E)

Resolution
Camera Sensor Trend

- Image quality enhancement is also improving
System Semiconductor Industry

Samsung System LSI : Now

Looking Forward
Three business areas

- **SOC**
  - AP Connectivity

- **Foundry**

- **LSI**
  - Image Sensor
  - Display Driver IC
  - Smart Card IC
  - Power Management IC
Product Portfolio

- Powerful CPU/GPU
- Low Power
- PMIC line: AP & OLED
- High Efficiency
- High Accuracy
- Smartphone
- IoT
- Pixel Leadership
- Slim Solution
- World’s Best Performance
- Low Power Consumption
- High Density e-SE Module
- Full line up for next FHD
- Lower Power solution
- Fast Speed (New Architecture)

- WiFi/BT
- GPS
- NFC
- SIM
- Camera Sensor
- Display Driver IC
- PMIC
- T-Con
- eDRAM
- T-con
- Backlight control
1. AP (Application Processor)

- Focusing on high performance with low power consumption

**CPU Leadership**

*Game changing technology:*

big.LITTLE octa core

**Powerful GPU**

*Richer 3D graphics with Energy efficiency*

**Low Power**

*Advanced mobile process & design methodologies*
Computing Power

- Has been leading AP industry since 2009
  - Innovation in both Architecture & Silicon Technology

*Source: Samsung Electronics Co., Ltd., ARM

*DMIPS: Dhrystone Million Instructions Per Second
big.LITTLE Architecture

• Best of both worlds: high performance and low energy
  ▪ Heterogeneous architecture for energy efficiency
big.LITTLE Architecture

- 20% gain at performance and energy, respectively

Performance

Higher is Better

+ 20%

big.LITTLE Conventional

*Source: Samsung Electronics Co., LTD, 2013 2Q

Energy

Lower is Better

-15 ~ 20%

big.LITTLE Conventional

*Source: Samsung Electronics Co., LTD, 2013 2Q

*Conventional: big CPU only
• Leadership in low-power, advanced silicon process

- 90/65nm Strained Si
- 45nm ULK
- 32nm 1st Gen HK/MG
- 28nm 2nd Gen HK/MG
- 20nm 1st Gate Last HK/MG
- 14nm 1st Gen FinFET
- 10nm 2nd Gen FinFET

* Source: Samsung Electronics Co., Ltd.
* Vdd: Supplying voltage of drain
2. Image Sensor

- Higher resolution & smaller pixel have driven sensor industry

* Source: Samsung Electronics Co., Ltd.
Pixel Architecture

• To increase sensitivity and decrease light loss & crosstalk

- **Gap-less u-lens**
  - Increase sensitivity

- **Deep PD**
  - Reduce loss in Si

- **Light-guide**
  - Reduce metal layer reflection

- **ISOCELL**
  - No light loss

- **Back-side illumination**
  - Remove metal layer reflection

- **Front-side illumination**
  - Back-side illumination

- **With color interference**

- **Without color interference**

- **Back-side illumination**

- **ISOCELL**

- **Front-side illumination**

- **Back-side illumination**
New Products for 2014-15

- **16Mp ISOCCELL Sensor with 1.12um pixels**
  - Main sensor for smartphones
  - Wide dynamic range & Auto focus

- **Next APS-C sensor**
  - Sensor for mirror-less cameras
Partnership with customers

One stop IP shopping and design support

Best service for development and mass production

Advanced technology and continuous capacity growth
14nm Achievement

- World’s leading 14nm FinFET solution via collaboration

- **Samsung**: 14nm FinFET test sample & Design Infrastructure ready

- **ARM, Cadence, Synopsys & Mentor**
  - FinFET Design Enablement Platform
  - First Cortex-A7 implementation
Technology & Capacity

* ISDA : International Semiconductor Development Alliance
System Semiconductor: Introduction

Samsung System LSI: Now

Looking Forward
1. “Widcon” & TSV (Through Silicon Via)
2. 64-bit CPU
3. FinFET Process
"Widcon" with TSV

- Wide connection between logic and memory
  - Higher bandwidth, lower power consumption

Memory Stacking with TSV

Short Connection with TSV

Micro Bump
• World’s 1st AP using Widcon & TSV

*Source: Samsung Electronics Co., Ltd., JEDEC, 2013 1Q
64-bit CPU core for Smart Devices

• 2-step approach:
  - AP with ARM’s 64-bit core
  - AP with Samsung’s own 64-bit core
• FinFET technology leadership
  ▪ Lower Vdd and delay than a planar process
New Business

1. ModAP (Cellular Modem + AP)
2. IoT
3. Foundry 2.0
1. ModAP (Modem + AP)

- Dual tracks for modem collaboration
  - High-end: 2-chip strategy with Tier-1 modem suppliers
  - Mid/low-end: ModAP using system company’s modem
• System LSI’s 1st ModAP was shipped in 3Q’13
2. **IoT (Internet of Things)**

- Smart building, Smart community, ... 
- Total connectivity solutions
3. Foundry 2.0

- Technical leadership ••• 14FF and beyond

1. Follower ➔ Technology Leadership
2. Tier 1 only ➔ Tier 1 + Tier 2/3
3. Silicon ➔ Silicon + IP Provider
Foundry 2.0

• 10nm FinFET Leadership
  ▪ Schedule
  ▪ Performance, power and area

• Early EUV Adoption

*SRD: Semiconductor Research & Development
Concluding Remarks

• Samsung S.LSI provides **total solution for connected world**
  - Mobile AP (Application Processor)
  - Image Sensor
  - ModAP
  - IoT

• Samsung S.LSI offers **attractive foundry solution**
  - Leading-edge technology: 14FF
  - Capacity
Thank You!