Market Perspective & Strategy

Kinam Kim, Ph.D
CEO, Samsung Display
US NAE Foreign Associate, IEEE Fellow
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.
Contents

I. Business Overview
II. Industry Outlook
III. SDC Core Competency
IV. SDC Strategy
Display Market History

Growth Engine: IT → TV → Mobile

1st Wave
- CAGR: IT 35%
- 1998: $7B
- 2004: $54B

2nd Wave
- CAGR: TV 35%
- 2010: $112B
- 2013(E): $128B

3rd Wave
- CAGR: Mobile 35%
- Mobile: 38%
- TV: 42%
- IT: 16%

※ Source: Display Search
※ Tablet is included in mobile
SDC has been continuously outperforming

Annual revenue growth (2006~2012)
: Market 8%, SDC 15%

Revenue
- 2006: $13B, 5%
- 2009: $19B, 5%
- 2012: $29B, 10%

Profit
- 2006: 1%
- 2009: 0%
- 2012: -5%

※ Source: Company IR
※ Avg. of top 4 players
SDC has been operating the capacity efficiently.

- SDC Excellence: Operation

Revenue Share (Year 2012)

<table>
<thead>
<tr>
<th>Capacity Share</th>
<th>Revenue Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>22%</td>
<td>SDC (1.1)</td>
</tr>
</tbody>
</table>

- A (0.9)
- B (0.9)
- C (0.8)
- D (1.1)
- E (0.6)

* Source: Company IR, Display Search Capacity
SDC Excellence: Market Leadership

SDC is the No.1 in 4 major applications

- Smartphone: 45%
- Tablet: 32%
- Large-size TV: 30%
- PID: 50%

(2013.1H Revenue)

※ Source: Display Search
SDC Excellence: Technology Leadership

**Ultra Large LCD TV**
- FHD (65”/75” 240Hz)
- UHD (65”/85” 120Hz)

**55” Curved AMOLED TV**
- Smart Dual View (240Hz)
- Deep Black / High Contrast
- Vivid Color

<table>
<thead>
<tr>
<th>Year</th>
<th>Ultra Slim (Edge-LED TV)</th>
<th>Ultra Large (75”FHD)</th>
<th>Ultra Large (65”/85”UHD)</th>
<th>Curved AMOLED TV (55”FHD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>Best Picture Quality (240Hz)</td>
<td>Ultra Slim Bezel (3.95mm)</td>
<td>(55”FHD)</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td></td>
<td>(65”/85”UHD)</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* FHD: 1920 x 1080, UHD: 3840 x 2160
Curved & Wearable

- World 1st FHD Flexible Display
  - Display on plastic film

<table>
<thead>
<tr>
<th>On Cell Touch (OCTA)</th>
<th>High resolution (FHD: 440ppi)</th>
<th>Flexible &amp; Wearable</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>2013.1H</td>
<td>2013. 2H</td>
</tr>
</tbody>
</table>

※ OCTA : On Cell Touch AMOLED
Business Portfolio

SDC evolves to well-balanced portfolio

※ Source : SDC
AMOLED drives the growth of the company

※ Source: SDC
Everyone and everything are connected seamlessly
Key Elements of Hyper Connected World

- Cloud
- Database
- Computer
- Storage
- D2D (Device to Device)
  Unlimited and fast sharing of contents

High speed connectivity
Display is the key component of smart devices in the cloud environment

<table>
<thead>
<tr>
<th>Computing</th>
<th>Standalone Smartphone</th>
<th>Cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computing</td>
<td>Quad 2.3Ghz</td>
<td>infinity</td>
</tr>
<tr>
<td>Storage</td>
<td>32GB</td>
<td>infinity</td>
</tr>
</tbody>
</table>

Both value and demand of display will increase
High Speed Connectivity

Network revolution → Multimedia experience:
High performance display

4G LTE-Advanced

- ~150Mbps
- ~1Gbps
- ~3Gbps

(3GPP* Rel.11)

<table>
<thead>
<tr>
<th>2 hours movie data</th>
<th>2013</th>
<th>2014</th>
<th>2015~</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full HD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WQHD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UHD</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Download time</th>
<th>2013</th>
<th>2014</th>
<th>2015~</th>
</tr>
</thead>
<tbody>
<tr>
<td>280sec</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65sec</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35sec</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Source: Cisco Data Meter, 2013)

% of data consumption

- Video
- Information*
- Web
- SNS

※ 3rd Generation Partnership Project
※ WQHD: 2560 X 1440

※ App. & Push Information
Device to Device

Trillion devices will be connected, display is the window

UHD video streaming ‘Display of things’
[IEEE 802.11ac/ad]

FHD video streaming ‘N-Screen’
[IEEE 802.11n]

Picture, Voice
[IEEE 802.15]

Wireless LAN speed
2009
20 Mbps
10 m Range

2013
300 Mbps
50~100 m Range

2015~
7 Gbps
100~250 m Range
Display Centric World

Display is the window for the world. "5 Every..."

Where

Time

Thing

Body

Purpose

One day with display
Contents

I. Business Overview
II. Industry Outlook
III. SDC Core Competency
IV. SDC Strategy
SDC Core Competency

**Legacy**
Distinguished track record in display and semiconductor

**Advanced Technology**
World largest AMOLED & Flexible IP portfolio
Technology readiness for Flexible AMOLED

**Operational Capability**
AMOLED, the 1st commercialization to 500M cumulative units produced

**Eco-System Leadership**
Vertical integration: Samsung affiliates & other partners
Distinguished track record in display and semiconductor

**World Best Display**
- World 1st AMOLED MP: 2007
- LCD M/S No.1: 2000
- LCD MP Start: 1995

**World Best High Density Technology**
- Encapsulation
- Substrate (Glass or Plastic)
- 1440 x 2560
- 11,000,000

**No. 1 in Market Share since 2000**

No. 1 Fine Patterning Technology Synergy with Semiconductor Tech.
Advanced Technology

World largest AMOLED & Flexible IP portfolio

**Strong IP** Portfolio

<table>
<thead>
<tr>
<th>Year</th>
<th>SDC AMOLED Patents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>2,285</td>
</tr>
<tr>
<td>2008</td>
<td>5,072</td>
</tr>
<tr>
<td>2010</td>
<td>7,045</td>
</tr>
<tr>
<td>2012</td>
<td>9,469</td>
</tr>
</tbody>
</table>

**Flexible related Patents**

- Samsung 33%
- A 21%

(2013. Sep. US)

**Dedicated Line for New Technology**

Able to validate manufacturability for ‘Design for Manufacturing’
Technology readiness for flexible AMOLED

Evaporation

- Substrate
- World 1st RGB evaporated AMOLED Mass Production
- 45 um (560 ppi)

X4 times

Key Technology for Flexible

- Encapsulation
- Substrate (Plastic)

Thin Film Encapsulation

- Acquisition of essential patents for TFE (Sep.2010)
  - TFE: Thin Film Encapsulation

Plastic Substrate

- Establishment of Joint Venture, SUM (Aug.2011)
  - SUM: Samsung Ube Materials

※ High ppi (pixel per inch) = High resolution
SDC has proven capability to bring the new technology to the large scale mass production.
Organize AMOLED ecosystem through JVs & capital investment

**Ecosystem**

**OLED Structure**

- **Encapsulation**
  - TFE equipment
  - Capital Investment: A Company

- ** Emitting Layer**
  - Organic material
  - Soluble material
  - through SVIC

- **TFT**
  - Laser equipment
  - B Company

- **Substrate**
  - (Glass or Plastic)
  - Samsung Corning Advanced Glass
  - Samsung Ube Materials
  - C Company

※ SVIC: Samsung Venture Investment Corp.
Strategy Framework

Command Current Market

- Architecture
- TV
- Retail

Create New Opportunities

- Automotive
- Tablet
- Education

- Wearable
- Smartphone
- Healthcare
Trend: Smartphone

**Competition: Color → Resolution → Design Innovation**

### Change of Differentiation Factors in Mobile

<table>
<thead>
<tr>
<th>Color</th>
<th>Resolution</th>
<th>UX + Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>256K</td>
<td>X63</td>
<td></td>
</tr>
<tr>
<td></td>
<td>QVGA</td>
<td>X48</td>
</tr>
<tr>
<td></td>
<td>WQHD</td>
<td>Flexible</td>
</tr>
</tbody>
</table>

### Smart Phone Market

- **Flexible Penetration:**
  - 2000: 0.2%
  - 2014: 12%
  - 2018: 40%

- **($Bil.):**
  - 2013: 30
  - 2015: 43
  - 2018: 50

* Source: Display Search, SDC

*QVGA: 320 x 240*
Strategy: Smartphone

H/E value up with Flexible, M/E penetration with AMOLED

AMOLED Base Benefit

- Contrast (2,000,000:1 vs 1,000:1)
- Color gamut (100% vs 70%)
- Response Time
- Thin & Light
- Power Efficient

Flexible

Profit Maximization

Cost Performance

Scale Economy
Material Innovation
High resolution and low power display for various usages

Trend: Tablet

"Usage Diversification"

Medical
Photo
Game
Education
Business

Display Needs
- Slim & light
- High resolution
- Low power

WQXGA
5% → 50%
LTPS/Oxide (including OLED) 5% → 60%

Market

2013
12

2015
19

2018
28

*$ WQXGA: 2560 x 1600

*$ Source: Display Search, SDC
Strategy: Tablet

Cover all segments: AMOLED for H/E, Oxide for M/E, a-Si for L/E

"Bigger & Finer"

Key Value

- AMOLED (LTPS-Based)
  - Excellent Performance
  - Flexible
  - Slim & Light (40 ~ 45%)
  - Color Gamut (1.4 times larger)

- Oxide LCD
  - Optimized Performance & Cost

- a-Si LCD
  - Competitive Cost Structure
Real Image, Large size and Immersive Design

**Trend**

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>FHD</td>
<td>X4</td>
</tr>
<tr>
<td>UHD</td>
<td>X4</td>
</tr>
<tr>
<td>QUHD</td>
<td></td>
</tr>
</tbody>
</table>

**Color (Broadcasting)**

- Wide color gamut (NTSC)
  - (HD) 71%
  - (UHD) 100%

**Size**

- Mainstream Avg. size
  - 35” Class ’11
  - 40” Class’15

**Design**

- Flat
- Curved

**Market**

- UHD
  - 48”
  - 4% 2013
  - 13% 2015
  - 25% 2018

- $Bil.
  - 2013: 53
  - 2015: 55
  - 2018: 55

*QUHD: 7680 X 4320

*Source: Display Search, SDC
Dominate market with leading edge technology

- **Advanced Performance**
  - **High Picture Quality**
    - Motion blur-less 240Hz
    - Super Large UHD/QUHD
  - **Superb Design**
    - Immersive Curve
      - 7000~8000R
      - Ideal Curvature
      - Industry
      - SDC

- **Main stream**
  - **High Resolution with Low Power**
    - UHD
    - Green UHD
    - FHD
    - Full (2M)
    - HD
    - Ultra HD (4K)
  - **Slim Display with Narrow Bezel**
    - D - LED
    - Narrow bezel
    - Slim D - LED
    - Super Narrow Bezel
Create New Opportunities

Continuously expanding to different applications
Trend: Wearable

Wearable usage increase in always connected world

Wearable Device Market Forecast

<table>
<thead>
<tr>
<th>Year</th>
<th>Demand (Mpcs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>200</td>
</tr>
<tr>
<td>2015</td>
<td>300</td>
</tr>
<tr>
<td>2018</td>
<td>600</td>
</tr>
</tbody>
</table>

CAGR 22%

Source: Allied Business Intelligence Research

Trend in Wearable

- Glasses
- Watch
- Wristband
- Shoes

AMOLED Value

- Flexible
- Ergonomic Design Innovation
- Slim & Light
  - 40% Thinner & Lighter
- Longer Battery Life
  - About 65% of LCD’s
- Low Power Consumption
  - 2.5” WQVGA (400X240), 52% On Pixel Ratio
Strategy: Wearable

Create wearable market with Flexible and sensor integration

Design Evolution
- Curved
- Bended
- Foldable
- Stretchable

Sensor Integration
- Position & Motion Sensor
  - GPS, Gyroscope, Accelerometer
- Bio Sensor
  - Blood glucose, Pulse, Temperature

Application
- Watch (2013~)
- Fitness & Healthcare (2015~)
- Fashion (2018~)
In the near future, AMOLED will replace TFT LCD

**Trend in Automotive**

<table>
<thead>
<tr>
<th>AMOLED Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contrast</strong> (2,000,000:1 vs 1,000:1)</td>
</tr>
<tr>
<td>‘True black’, Less eye fatigue</td>
</tr>
<tr>
<td><strong>Color Gamut</strong> (100% vs 70%)</td>
</tr>
<tr>
<td>Natural, saturated, consistent color</td>
</tr>
<tr>
<td><strong>Low Temp. Response Time</strong></td>
</tr>
<tr>
<td>No staggering in extreme coldness</td>
</tr>
<tr>
<td><strong>Power Consumption</strong> (for EV)</td>
</tr>
<tr>
<td>About 60% of LCD’s</td>
</tr>
<tr>
<td><strong>Flexible</strong></td>
</tr>
<tr>
<td>Design innovation, Unbreakable</td>
</tr>
</tbody>
</table>

"Nothing flat inside & Unbreakable"
Strategy: Automotive

Enter the market with AMOLED based differentiation from 2016

- **RSE & CID** (2016~)
  - Excellent video quality

- **Cluster** (2017~)
  - Vivid color, true black

- **Flexible & new application** (2018~)
  - Innovative design
  - Safe for collision e-mirror
E-textbook will evolve to Vook, rapidly replacing paper book

* Video Book

**US Digital Textbook Adoption**

(Source: SETDA)

* SETDA: the State Educational Technology Directors Association

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usage</td>
<td>19.5%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Total Cost of Ownership

- **$ 2,100** Paper Textbook (High school 3 Years (USA Today))
- **$ 1,250** Digital Textbook (Contents + H/W) (Gartner, OnlineEducation)
Create video book market with AMOLED

<table>
<thead>
<tr>
<th>VOOK (Video + Book)</th>
<th>Flexible</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> Color in <strong>Printed Media</strong></td>
<td><strong>1</strong> Safety (Unbreakable)</td>
</tr>
<tr>
<td>AMOLED (Adobe RGB 97%)</td>
<td>LCD (Adobe RGB 74%)</td>
</tr>
<tr>
<td><strong>2</strong> High Contrast ratio &amp; Resolution for <strong>Readability</strong></td>
<td><strong>2</strong> Mobility (Carrying Small Seeing Big)</td>
</tr>
<tr>
<td><strong>3</strong> Fast Response time for <strong>Video Contents</strong></td>
<td></td>
</tr>
</tbody>
</table>
Strategic investment will secure growth momentum

**CAPEX Plan**

<table>
<thead>
<tr>
<th>Year</th>
<th>CAPEX ($6B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td></td>
</tr>
</tbody>
</table>

**Strategy**

- **Secure AMOLED growth**
  - Asan (Korea)

- **Sustain growth momentum for LCD**
  - Suzhou (China)
“What is seen is all of our business area!”

Annual revenue growth (2012~2020)  
: Market 5%, SDC 15%
Final Remarks

Display industry's outlook is brighter than ever as potential market for displays will be immeasurable in the future.

SDC will continue to lead the industry's growth through innovative products enabled by our technology leadership.

The innovative ways of SDC will create new opportunities, which will allow the realization of

"Display Beyond Imagination"
Thank You