Creating New Display Market in China with innovative Splendid LCOS Technology

September, 2012

Wuhan Splendid Optronics Technology Co., Ltd.
## Future Market Requirements

**Green (Low power), 4K2K+, Real 3D**

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Which one is better Between LCD and LCOS</th>
<th>Highlight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cost</td>
<td></td>
<td>LCOS: Promising Innovative Technology</td>
</tr>
<tr>
<td>2</td>
<td>Lower Power Consumption (&gt; Energy Star 5.3)</td>
<td></td>
<td>LCD: Needs only Volume For ROI like CRT Display</td>
</tr>
<tr>
<td>3</td>
<td>Higher Resolution (&gt;1080p to 4K2K and more)</td>
<td></td>
<td>Key Success Factor: How to integrate - Higher Speed - More memory - Higher resolution - 3D feature</td>
</tr>
<tr>
<td>4</td>
<td>Lighter</td>
<td></td>
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<tr>
<td>5</td>
<td>Smaller form factor (embedded)</td>
<td></td>
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</tr>
<tr>
<td>6</td>
<td>No Display Size limit</td>
<td></td>
<td></td>
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<tr>
<td>7</td>
<td>Memory Architect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Higher Processing Speed (&gt;HDMI1.4/DP1.2/new)</td>
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</tr>
<tr>
<td>9</td>
<td>Real 3D</td>
<td></td>
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</tr>
<tr>
<td>10</td>
<td>Non Radiation</td>
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</tr>
</tbody>
</table>
Fast Growing HD+/3D Market

**WSOT targets China Market**

DTV: 20M units in 2012 to > 50M units in 2015

(* * * 4K2K: 100K in 2013 to More than 1M in 2015)

3D DTV: 10M in 2012 to > 25M in 2015

(Source: WSOT internal)
LCD TVs are targeting 4Kx2K and 8K×4k in 2013

85”, 8K×4K (7680 × 4320) from Sharp
The residential energy consumption due to televisions rapidly increased from 3-4% in 1990s to 8-10% in 2008. Television energy will grow up to 18% by 2023 without regulations. "The residential energy consumption due to televisions rapidly increased from 3-4% in 1990s to 8-10% in 2008. Television energy will grow up to 18% by 2023 without regulations." by California Energy Commission in USA.
Why LCOS?
Low cost, High resolution, Low Power, High Speed based CMOS Semiconductor

• Green Display Technology
  – Target market: Large Size Display and Mobile Application

• Embedded projection engine is moving into mobile and new application market.

• Lower power, 4K2K+, 3D, High Speed Display are the key for next Display Technology
Why WSOT?

I. WSOT 3 Key Core Technology Elements

1. LCOS Panel Design
   * Low power, high speed 4K2K+ LCOS Panel with built-in driver with auto scaling, gamma control

2. LCOS Panel Packaging
   * High Yield Packaging for Mass Volume

3. System Manufacturing with Low Cost High Performance Light Optical Engine

II. WSOT 4 Key Factors for China/Global LCOS Leadership

1. Building up Strategic business relationship with Key Suppliers
   1) TSMC/Fujitsu (move to 12” wafer based on 0.13um design)
   2) Global Top Optical component supplier (LED/PBS/Lens)
   3) Build up Global Supply Camp in China New Light Micro Display Central Industry Zone

2. Building up Advanced Auto LCOS Packaging Line to handle 12” Wafer

3. Every 6 month New Product Launching with Strategic OEM customers starting at CES2013

4. Developing China 4K2K+ 3D LCOS Standard to be LCOS Leader
WSOT Highlights

• WSOT is the only company who has its own complete solutions for LCOS Display in China.
  – 100% Own proven Technology & Manufacturing
    1) 0.74” 1080p+ LCOS Imager IPs
    2) Proven High Yield LCOS Packaging Factory (VAN and TN)
    3) Own Optical Engine Design
       • CQ3
       • 3D Dual LCOS Panel
    4) Mass volume RPTV/Projector Production
       • 71” RPTV and Databoard, Video Wall
       • 3D Dual LCOS Mini projector
       • Embedded Optical Engine
       • New Light Source Development

– Own Supply Chain with World Top Class Suppliers
– LCOS leader for Next Generation 4K2K+ LCOS Standard
WSOT Global Organization

LCOS Design
- LCOS Imager Design (4K2K)
- New Microdisplay development
  - Backplane & driver
- New LED driver IC
- MCU, AV controller IC

Hong Kong/USA/Korea

LCOS Packaging
- LCOS Panel Manufacturing
- Advanced LCOS Packaging
- Small Sized LCOS Solution

Wuhan

System Manufacturing
- Large sized LCOS Display Manufacturing
  - 71” LED Databoard,
  - Multi Video wall
- 3D Mini/Mobile Projector
- New Light Optical Engine

Wuhan
I. WSOT LCOS Patent and IPs
Why WSOT LCOS Will Win?

WSOT’s Core Competence

• Unique design architecture results **high yield 60% +**
• Proprietary LCOS chip architecture solved flickering problem in analog pixel design; And continue to work on digital LCOS design with built-in driver at high speed and better thermal effect.
• New cell layouts of LCOS chip solved progressive dead pixels
• New entire manufacturing process flow of LCOS chip
• Nanotechnology (CNT) for cell gap uniformity solved cell gap uniformity
• Reflection improvement technology on the surface of LCOS chip
• Ease of migration to next generation higher resolution with same reflective area.
• Technical advantage over MEMS or DMD in the long run.
WSOT LCOS Design IP Highlights

WSOT San Jose LCOS Design Team in USA has been delivering and designing its proprietary proven design IPs in Microdisplay areas since 1997.

- **LCOS Microdisplay**
  - Display Backplane – Design
  - Controller ICs – Design and Supply
- **Transmissive Microdisplay**
  - Microdisplay Controller ICs – Design and Supply
- **MEMS Microdisplay**
  - Display Backplane – Design
  - Driver ICs – Design and Supply
- **OLED Microdisplay**
  - Display Backplane - Design
  - Controller ICs – Design and Supply
WSOT 4K2K LCOS
China LCOS HD+ Standard
(4K2K+, High Speed 3D LCOS)

Splendid LCOS
0.74” 8K4K+ (201x)

Splendid LCOS
0.74” 4096x2240 (2013)

Splendid LCOS
0.74” 2048x1120 (now)
WSOT LCOS Panel Roadmap

1st 4K2K
(Theater)

0.74” 3P Analog
2048x1120

0.44” 1P Digital
1024x600

0.37” 1P Digital
800x600/1280x720

0.21” 1P Digital
854x480

2nd 1080p+
(Home Theater)

0.74” 1P/2P/3P Digital
with built-in Driver IC
4096x2240

0.44” 1P Digital
with built-in driver
2048x1120/2560x1440

Syndiant

3rd 1080p
(Mobile)

0.21” 1P Digital
1280x720/2048x1120

Syndiant

Syndiant

Syndiant
II. WSOT LCOS Packaging Process IPs

1. >60% High Yield targeting 80% (Global Top)
2. Proven High Yield Proprietary Process IPs
3. Own Process for WSOT 0.74” LCOS
4. Newly development efforts for all digital 0.21”/0.37”/0.44” LCOS
WSOT LCOS Packaging Process Highlights

- Silicon Backplane from TSMC/Fujitsu
- Sawing
- Inorganic Alignment Layer
- Assembly of Backplane & Glass
- Optimized alignment angle
- Higher yield by wider window of uniformity control
- L/C Fill
- OQC
- Uniform Screen Image
- Electrode Attachment
WSOT LCOS Packaging Highlights

- **1st and only one Fully localized 1080p LCOS Plant in China**
  - Dedicated LCOS Cleanroom (Class 100, 1000, 10000) facility
  - Monthly facility capacity of 0.74” x 12,000 panels single shift.
  - Enhanced LCOS Imager production process
  - Inorganic VAN alignment & TN process
  - Constant Gap uniformity
  - Proven optical probe testing to detect all major panel & pixel defects
  - Excellent panel performance & reliability
III. WSOT Optical Engine (OE) Design IPs

1. Embedded Optical Engine Solution for New Mobile Application Market
   * Application: 2D/3D StoryBox, Mobile phone, HUD

2. New LED Optical Engine Solution for Large Sized Display Market
   * Application: 71”/85” LED Databoard/HDTV, >200” Front Projector, Video Wall
WSOT OE/Product Roadmap

Large Display Application

- n x n Video Wall (71” cube)
- 103” RPTV
- 71” OE/RPTV with UHP
- 1500 lumen Front Projector
- 71” 1080p RPTV LED 500 lumen
- 3D mini 0.44” 720p 200 lumen
- 0.21” Embedded 15/20 lumen

Mobile Application

- >200” Front Projector 3000/6000 lumen 4K2K 3D
- 85” 4K2K RPTV 3D LED 1500 lumen
- 85” RPTV/200” FP 3D Engine LED 3000 lumen
- 71” 1080p RPTV LED 1000 lumen
- 3D 0.74” LCOS 1080p 500 lumen
- 3D mini 0.37” 720p 300 lumen
- 0.21” Embedded 30 lumen

2012-2013
Use Syndiant 0.21 inch panel, support WVGA (854x480) resolution
• 4.5cc optical engine size, 6mm thickness
• 15/20 ANSI Lumen
• 9 point Uniformity better than 20%
• 44% system efficiency improve by PCS
Size comparison with DLP

WSOT

24.5 X 36 X 6.0 mm
4.5 cc

TI DLP

The size of the module:
(not include the mirror on the top)
26*24*6.5, 4.1 cc
WSOT 3D Dual LCOS 0.44” Engine Spec
(The smallest 3D LCOS dual panel OE)

• Light source: (Ostar Q6WP)
• LCOS: Syndiant 0.44” WSVGA (1024x600, 720p)
• Brightness uniformity: >80% (2D 200 lumen, 3D 100 lumen)
• Contrast: >150:1 (with QWP & PPL)
• TV Distortion: <1.5%
• System efficiency: 22% (Osram Ostar)
• Size: 28 x 94 x 28mm
• Volume: 55cc
<table>
<thead>
<tr>
<th>型号 Model</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>尺寸 Dimension</td>
<td>28mmx28.5mmx96mm</td>
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<tr>
<td>Dual LCOS</td>
<td>1024x600 (WSVGA) LCOS x 2</td>
</tr>
<tr>
<td>Support Resolution</td>
<td>1280x720 (720P)</td>
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<tr>
<td>对比度 Contrast</td>
<td>Up to 200:1</td>
</tr>
<tr>
<td>亮度 Brightness</td>
<td>Up to 200 lumens@30watt</td>
</tr>
<tr>
<td>纵横比 Aspect Ration</td>
<td>16:9</td>
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<tr>
<td>功耗 Power</td>
<td>35watt (LED)</td>
</tr>
<tr>
<td>接口 Interface</td>
<td>Micro HDMI, VGA, USB, SD-Card</td>
</tr>
<tr>
<td>Key Feature on the WiFi</td>
<td>Office Viewer, DoUSB, DoWiFi, DLNA</td>
</tr>
<tr>
<td>净重 Net weight</td>
<td>390g</td>
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<tr>
<td>核心技术 Core Technology</td>
<td>Dual-LCOS</td>
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WSOT CES 2012 New Announcement to Market

The World First 3D Dual-LCOS Mini Projector and iPhone Projector at CES 2012
WSOT CES 2012 Highlights

China No. 1 LCOS Display Leader
from LCOS Imager Design/Packaging
to Complete Product Manufacturing

3D Mini Projector
LCOS: 0.44” WSVGA (2 dual panel)
Size: 40cc
Light Source: RGB LED
Power: 30 W
Brightness: 180 ANSI lumen
Contrast: 100 : 1

Embedded Engine
LCOS: 0.21” WVGA
Size: 4 cc
Light Source: RGB LED
Power: 1 W
Brightness: 11 ANSI lumen
Contrast: 250 : 1
WSOT Proprietary CQ3 LCOS OE Design

WSOT LCOS Imager

- Indium Tin Oxide
- Liquid Crystal
- Silicon
- Mount
- Alignment Layer
- Anti-Reflective Coating
- Cover Glass
- Flex

WSOT CQ3 Assembly

For Large Display
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<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>OE Line</td>
<td>1</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>TV Line</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Projector Line</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

WSOT Cell based Manufacturing Line for 71” Databoard

一期投资生产 1K/M

二期投资生产 10K/M

三期投资生产 100K/M
Splendid LCOS Strategic Focus

1. Commercial/Education
2. Smart Phone with LCOS
3. Green TV

LCOS Memory Architecture, New Light Source

New 3D Engine Embedded Engine
China LCOS HD Standard

Creating New Business
Splendid LCOS Business Strategy

1. Create **New Volume Market**

2. Build up **China LCOS HD Standard**
   * Enhance & Strengthen Advanced IP

3. Quick ROI with **Delivering Optimizing Solution**
   * 3D Pico & Mobile LCOS OE, Large 3D OE

**Now is “Time for Marketing” !!!**
Splendid LCOS IT Complex
China New Light Micro Display Central Industry Zone
Splendid LCOS

China New Light Micro Display Central Industry Zone
Thank you very much