Leading Green LCD “VIDification”

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AGENDA

- VIDification

- Enabling Technologies
  - New PenTile Technology
    LCD and OLED
  - New Panel Structures
    L/C, Aperture
  - New Backlighting Structures
    CCFL, LED, Dimming

- Travel Less – Experience More
  - 3D, Ultra Definition

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VIDification

Extending the movie experience, everywhere

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Where Do Consumers Get Video Content?

“1 million Xbox members use movie service”

“...watched 1.5 billion minutes of movies and TV through its Watch Instantly video service”
VIDification Trend

Wide Aspect Ratio → 16:9
Higher Resolution → 1080p
Content → Online, Real-Time, Personal
Screen Size → Wider and Bigger

Green Needed More Than Ever

Smart Phone

Monitor

Notebook

Source: Gartner

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GREEN Enabler: PenTile
Mobile Megatrend: More Content, Richer Experience

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PenTile Technologies

Conventional RGB

LCD PenTile Matrix™

OLED PenTile Matrix™

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LCD PenTile RGBW

White Is the New Green

How It Works

- Red, Green, Blue
- + White sub-pixel
- 1/3 larger sub-pixel
- Driver IC renders same input signal

Benefits

- High Resolution & Lower Cost
  - a-Si High Resolution (> 200ppi)
  - 5~10% Cost saving (vs LTPS)
- Better Light Efficiency (up to 2X)
  - Less # of LEDs or Higher Brightness
- Simple Panel Structure
  - One-third fewer pixels
  - 1 Chip Driver IC
  - Lower Power Consumption

1. RGB → RGBW
2. Sub Pixel Rendering

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OLED PenTile Matrix™

- OLEDs only consume power for active pixels
- OLED lifetime tied to current density
  - Excessive current density, shorter lifetime
- PenTile can increase pixel size by 33%
  - reduces current density
  - dramatically increases lifetime
- PenTile technology enabler hi-res OLED smartphones

For high resolution OLED applications

PenTile Matrix™ offers 30% less current density - larger aperture

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GREEN Enabler: Panel Structure

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Lower Power Panels

Low Voltage Liquid Crystal (L/C)

- Logic Power
  - '08: 100%
  - '09: 90%
  - '10: 85%
  - 10% improvement

New Panel Structure

- High Aperture Ratio Structure
  - '08: 100%
  - '09: 88%
  - 12% improvement

- Aperture ratio improved
- Logic power lowered via lower panel load

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GREEN Enabler: Backlight Structure

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NOTEBOOK: Power Savings with LED

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MONITOR: Slim & Low Power CCFL

Lamp Reduction

Direct 6U Lamp

Edge 4 Lamp

Edge 2 Lamp

Benefits

Energy Saving

35% ↓

60% ↓

Ref.

6 CCFL (U-Type)

4 CCFL

2 CCFL

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Greener TV Panels – Efficient CCFL

Increasing Panel Transmittance + Lowering Lamp Power + Enhancing Optical Sheets

Technologies for low power

- High Transmittance Panel
- Less CCFLs Lamp
- New Diffusion Plate
- New Optical Sheet

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### Greener TV Panels – Edge-lit

#### Comparison Table

<table>
<thead>
<tr>
<th></th>
<th>Direct-lit</th>
<th>Edge-lit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>1080p</td>
<td>1080p</td>
</tr>
<tr>
<td>Thickness</td>
<td>49.5mm</td>
<td>10.8mm</td>
</tr>
<tr>
<td>Weight</td>
<td>25kg</td>
<td>15.5kg</td>
</tr>
<tr>
<td>Brightness</td>
<td>450nit</td>
<td>450nit</td>
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<tr>
<td>Power</td>
<td>30% (Less than CCFL)</td>
<td>50% (Less than CCFL)</td>
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</tbody>
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- Thinner
- Less Power

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GREEN Enabler:
Travel Less Experience More

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EXPERIENCE
BEING THERE
without traveling

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LCD Displays Truly Come to Life

3D TelePresence between Hong Kong and London

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Don’t Just Watch it...
...Be Part of the Experience
Ultra Definition

Looking Through a Window

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GREEN VIDification Enablers

Power Reduction - *Mobile, Notebook, Monitor and TVs*

- **PenTile** – Up to 50%
  - *White is the New Green In Mobility*

- **New Panel Structures** – 10%+
  - Integration, Materials, Engineering

- **New Backlighting Structures** – Up to 60%
  - Efficient CCFL
  - LED - Dimming

**Questions?**

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## Product Showcase

<table>
<thead>
<tr>
<th>Storage</th>
<th>Hard Disk Drives</th>
<th>Solid Disk Drives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F2EG 1.5 Terabyte EcoGreen HDD</td>
<td>Enterprise Class: 50GB and 100GB</td>
</tr>
<tr>
<td></td>
<td>S1 Mini External HDD</td>
<td>Notebook/PC: Up to 256GB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LCD</th>
<th>DID</th>
<th>Mobile Displays</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40” Edge-Lit LED Ultra-Slim LCD TV Panel</td>
<td>3.1” wVGA PenTile™ OLED</td>
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<tr>
<td></td>
<td></td>
<td>3.16” wVGA PenTile™ LCD</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DRAM</th>
<th>Samsung DDR3 2Gb Component Based Solutions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DDR3 Modules</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16GB Q R DDR3-1066 RDIMM</td>
<td></td>
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<tr>
<td></td>
<td>8GB DR DDR3-1333 RDIMM</td>
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<td>4GB DR DDR3-1333 UDIMM</td>
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<td>4GB DR DDR3-1333 SoDIMM</td>
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Power Green Lunch

Media Center on Website for presentations and press releases


Thank You!

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