New Business Development: JDI’s Reflective Color LCDs

Strengthening our non-mobile product portfolio and BtoB business

Shuji Aruga
Director and COO

June 15, 2015
I. Medium-term management goals
   • Non-mobile business sales ratio 30%+ by FY2020

II. Business development: JDI’s reflective color LCDs
   1. JDI’s reflective color LCD core technology
   2. Reflective color LCD applications
   3. Target markets (growth expectations, core tech & customer value)
      (1) Wearable devices
      (2) Industrial devices
      (3) Electronic shelf labels & PoP
      (4) Special-purpose PC monitors/readers
      (5) Digital signage

III. Summary
   • Sales target
I. Medium-term Management Goals

- 3 years: Achieve an overwhelming leading position in the smartphone market
- 5 years: More than 30% of sales derived from non-mobile display business (automotive, reflective LCD, OLED)
II. Business development: JDI’s reflective color LCDs
1. JDI’s Reflective Color LCD Core Technology

Problems for customers

(1) Short battery life for mobile devices

Battery quickly depleted!

(2) Poor visibility outdoors

(2) Poor visibility outdoors

Reflective LCD solves transmissive LCD problems
Benefit of Reflective LCD — Ultra-Low Power

- Backlight unnecessary in illuminated areas → Saves power
- Memory in Pixel (MIP) → More power saving

Transmissive LCD

- Backlight
- Data writing

Reflective LCD

- No backlight
- MIP
- Approx. less than 0.5%*

*JDI estimates
What is “Memory in Pixel” (MIP)?

- Each pixel has built-in-memory (SRAM*)
  * Static Random Access Memory
- Data writing to memory for each frame unnecessary as each pixel holds data.
  → Result: ultra-low power consumption
- Uses LTPS-CMOS technology
Reflective Color LCD Issues

- Color filter reduces reflectivity ratio and darkens screen.

Reflects all light

Reflects only each RGB color

Reflectivity (brightness)

Monochrome

Color

Blue Pixel

Green Pixel

Red Pixel

Gets dark
Reflective Color LCD Reflectivity Remedies

JDI’s three core technology improvements

JDI core tech (1) Scattering

JDI core tech (2) Pixel electrode material

JDI core tech (3) WhiteMagic™

Reflectivity

Brightness (image)

Monochrome  Color  LCF  Ag  RGBW
JDI Core Technology (1) – Scattering

- Improves reflectivity by optimizing LCF (light control film) characteristics

**Conventional technology**

Internal scattering

Scattering in all directions → Dark

**JDI core technology**

LCF (light control film)

Directional scattering → Bright

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Graph showing reflectivity levels across different technologies.
JDI Core Technology (2) – Pixel Electrode Material

- Highly reflective silver metal used in reflective electrodes

- Developed process technology using silver

![Graph showing reflectivity vs. wavelength for different materials (Ag, Al) and technologies (JDI core tech, Conventional tech).](image)
JDI Core Technology (3) – WhiteMagic™

- WhiteMagic™ improves reflectivity

Conventional tech

- RGB

JDI core tech

- RGBW

High reflectivity

WhiteMagic™ algorithm

Maintains RGB ratio & image quality

Insert white pixel

Reflectivity

Input data

Reflectivity

JDI core tech (3) WhiteMagic™
JDI Core Technology – Summary

JDI will make changes to everyday life through innovations in reflective color LCD

Problems for customers
- Battery runs out quickly
- Poor visibility in sunlight

→ Problems with transmissive LCD
→ Problems with OLED (self-luminous)

Solution

Reflective color LCD
- Ultra low-power consumption
- High visibility

JDI core technology
- LTPS
- MIP
- LCF
- Ag
- WhiteMagic™
2. Applications of Reflective Color LCD

Wearable devices
- 1.34”
- 0.99”
- 1.2”
- 1.39”

Special-purpose PC monitors/readers

Industrial devices
- 2～4”

ESL*/POP
- 2～3”
- 4”～
- 25”～

Digital signage
- 25”～

*ESL: Electronic shelf label
## 3. Target Markets

<table>
<thead>
<tr>
<th>Market type</th>
<th>(1) Replacing existing products and tech with reflective color LCDs</th>
<th>(2) Creating or uncovering new markets for reflective color LCDs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target applications</strong></td>
<td>Wearable devices</td>
<td>Special purpose PCs/ readers</td>
</tr>
<tr>
<td></td>
<td>Industrial devices</td>
<td>Digital signage</td>
</tr>
<tr>
<td></td>
<td>Electronic shelf label POP</td>
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</table>

| Entry scenario | Replace current products by solving problems for customers | Tap into potential market demand and create new markets |
Wearable Devices

Target mkt: Sports watches/health care products, leveraging MIP’s low-power consumption
→ High visibility and long battery life requirements fulfilled

Market size for wearable (watch) panels

(Billion yen)

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<thead>
<tr>
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<tbody>
<tr>
<td>JDI target</td>
<td>40</td>
<td>68</td>
<td>72</td>
<td>74</td>
<td></td>
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Source: JDI based on various data

Core technology and customer value

<table>
<thead>
<tr>
<th>Core technology</th>
<th>Lower power consumption via MIP</th>
<th>Reflective color LCD</th>
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<tr>
<td>Customer value</td>
<td>Longer battery life</td>
<td>Good visibility in sunlight</td>
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</table>
Outdoor Visibility (Photo)

OLED  Reflective Color LCD  Transmissive LCD
Industrial Devices

Target mkt: Industrial products used outdoors and/or with batteries
→ High visibility and color display for outdoor use
   Long battery life, light/small form factor

<table>
<thead>
<tr>
<th>Market size for industrial device panel</th>
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<tr>
<td>(Billion yen)</td>
</tr>
<tr>
<td>JDI target</td>
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<tr>
<td>Unit shipment</td>
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<td>Source: JDI based on various data</td>
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Core technology and customer value

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Electronic Shelf Label and PoP

Target mkt: Supermarkets, convenience stores, drug stores, high-class specialty stores (liquor, meat, fresh foods, etc.)
→ Effective ads with color display

Market size for Electronic Shelf Label

<table>
<thead>
<tr>
<th>Year</th>
<th>JDI target Unit shipment (in millions)</th>
<th>Source: JDI based on various data</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>47</td>
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<td>2016</td>
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<td>2019</td>
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<tr>
<td>2020</td>
<td>63</td>
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Core technology and customer value

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<th>Core technology</th>
<th>Lower power consumption via MIP</th>
<th>Color, operates at low temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer value</td>
<td>Longer battery life (button battery-powered)</td>
<td>Color ads, use in freezers</td>
</tr>
</tbody>
</table>
Special-Purpose PC Monitors and Readers

Target mkt: Office-use devices requiring intensive reading, eco-responsive PC monitors and lightweight tablets
→ Reduces eye strain, eco-friendly and lightweight

Core technology and customer value

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<td>Customer value</td>
<td>Eco-friendly, lightweight</td>
<td>Reduces eye strain</td>
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The photo is for illustrative purposes only.
Digital Signage

Target mkt: Outdoor or semi-outdoor public signage, displays adapted to surroundings in restaurants, museums etc. using front light
→ Solar panels to enable “location free” and “eco friendly”

Core technology and customer value

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<td>Customer value</td>
<td>Eco-friendly, emergency use in disasters</td>
<td>High visibility in sunlight</td>
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The photo is for illustrative purposes only.
Outdoor Visibility (Photo)

Photos of same outdoor menu illuminated by 50,000 lux

Reflective color LCD

Transmissive color LCD

Brightness: 270cd/m²
Touch Panel Application (1)

Multilingual information guides and provision of various smartphone services

Enables operation in sunlight, greater location-freedom, eco-friendly support
Touch Panel Application (2)

Information maps

Building guides

Multilingual applications

Photo is for illustrative purposes only.
Ⅲ. Summary
**Sales Targets**

**Reflective LCD sales target:**
- Replace existing products: ¥60bn
- Creation of new markets: ¥40bn

**OP margin target:** 10%↑

<table>
<thead>
<tr>
<th>Wearable devices</th>
<th>Industrial devices</th>
<th>ESL/POP</th>
<th>Replacement</th>
<th>¥60bn</th>
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<tr>
<td>Special-purpose PC monitors/readers</td>
<td>Digital signage</td>
<td>New markets</td>
<td>¥40bn↑</td>
<td></td>
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**Time**

- Mobile display
- Non-mobile display

- Automotive
- Reflective
- OLED

Reflective LCD business: ¥100bn↑