2017 Display Industry
Key words

November 2016
Large area Supply/demand forecast

Previous Large Area Supply/Demand Forecast

Latest Large Area Supply/Demand Forecast

Notes: ALL TFT includes AMOLED
Source: IHS

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2017 keyword for TV panels

- Unit shipment has less changes: 257M → 260M(1%) but key size zones have constraint.
- China looks “less aggressive in volume”

### LCD TV Panel shipment forecasting by size

<table>
<thead>
<tr>
<th>Million Units</th>
<th>&lt;32</th>
<th>32</th>
<th>39-43</th>
<th>45</th>
<th>46-48</th>
<th>49</th>
<th>50</th>
<th>55</th>
<th>58</th>
<th>60</th>
<th>65+</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016(F)</td>
<td>18</td>
<td>78</td>
<td>68</td>
<td>2</td>
<td>9</td>
<td>18</td>
<td>14</td>
<td>33</td>
<td>2</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>2017(F)</td>
<td>21</td>
<td>67</td>
<td>66</td>
<td>2</td>
<td>2</td>
<td>25</td>
<td>17</td>
<td>39</td>
<td>4</td>
<td>5</td>
<td>14</td>
</tr>
</tbody>
</table>

Notes: LCD TV only  
Source: IHS
2017 keyword for notebook PC panels

- China has ambition, 21%('16) → 29%('17)
- Overall sup/dem in 2017 looks similar to 2016 but China IPS yield rate is concern point.

Notebook PC panel shipment forecast by region (Preliminary)

<table>
<thead>
<tr>
<th>Year</th>
<th>Region</th>
<th>2015</th>
<th>2016(F)</th>
<th>2017(F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Japan</td>
<td>1%</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td>Korea</td>
<td>21%</td>
<td>32%</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>China</td>
<td>14%</td>
<td>21%</td>
<td>29%</td>
</tr>
<tr>
<td></td>
<td>Taiwan</td>
<td>43%</td>
<td>46%</td>
<td>48%</td>
</tr>
</tbody>
</table>

Note: TFT-LCD only
Source: IHS

Chart Title

LC mode forecasting in Notebook PC panel (Preliminary)

<table>
<thead>
<tr>
<th></th>
<th>IPS/PLS</th>
<th>TN</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016(F)</td>
<td>26%</td>
<td>74%</td>
</tr>
<tr>
<td>2017(F)</td>
<td>39%</td>
<td>61%</td>
</tr>
</tbody>
</table>
2017 keyword for Monitor panels

- Again, Chinese ambition, 23%('16) → 31%('17)
- Overall Sup/Dem in 2017 looks similar to 2016.
- However, consider IPS/PLS yield and quality, actual supply might lower.

**Monitor panel shipment forecast by region (Preliminary)**

- **2015**
  - Japan, 0%
  - Korea, 43%
  - Taiwan, 37%
  - China, 20%
  - **140M**
  - Set (139M)

- **2016(F)**
  - Japan, 0%
  - Korea, 40%
  - Taiwan, 37%
  - China, 23%
  - **137M**
  - Set (136M)

- **2017(F)**
  - Japan, 0%
  - Korea, 37%
  - Taiwan, 32%
  - China, 31%
  - **131M**
  - Set (133M)

**Notes:** TFT-LCD only
Source: IHS

**LC mode forecasting in Monitor panel (Preliminary)**

- **2016(F)**
  - TN: 54%
  - IPS: 38%
  - VA: 8%

- **2017(F)**
  - TN: 41%
  - IPS: 47%
  - VA: 13%

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Korean finds Exit with Business Optimization

- All applications expect big drop in volume shipment in 2017.

- Korean focusing “Exit & Optimize”
  - Exit strategy: IT panels, double digit decline for Unit and Area shipment
  - Optimize strategy: TV panels, focusing on large size and high-end. IT panels, only high-end.

![Chart Title]
Korean panel makers’ BP forecasting by application(Preliminary)

<table>
<thead>
<tr>
<th>Application</th>
<th>NoteBook PC</th>
<th>Monitor</th>
<th>LCD TV</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016(F)</td>
<td>51</td>
<td>55</td>
<td>99</td>
</tr>
<tr>
<td>2017(F)</td>
<td>32</td>
<td>49</td>
<td>90</td>
</tr>
</tbody>
</table>

Notes: TFT-LCD only
Source: IHS

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China Ambition – Prepare 2017, Invasion 2018

- 2017 for China, year of internal stability.
- Build up healthy product line up, various and valancing Portfolio.
- Less drive TV volume, expanding IT business while Korean makers retreat.
- Take #1 within 2018.
  - China Gen10.5 starts 2H2018.
LCD TV panel price trend in 2017

- Recent Price trend close to “1 year cycle”, Basically it is expected “上高下低” in 2017.
- But there are couple of factors can influence typical trend.
  - Supply shrinkage, TV brands still aggressive on volumes.

**Panel price changes during H2, 2008-2015 (HD/FHD, open cell), October 2016 update**

<table>
<thead>
<tr>
<th>Panel Size</th>
<th>Price Change % (December vs June)</th>
</tr>
</thead>
</table>

Notes: 1) 2H  price erosion of historical years is based on the price change between June and December. Q1 2016, Q2 2016 and Q3 2016 price erosion is based on the price change in the corresponding quarter. 2) From January 2016, prices of 49” and 55” are with the resolution of UHD.
Source: IHS

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2017 – Bull or Bear?

- Supply constraint continues
- Coming More Fabs shut down
- New fabs coming but needs more ramp up time
- Size migration Continues
- End market demand is uncertain
- LCD Fab Capacity up in 2017
- Brands’ profitability
- Effects from Innolux OEM partners strategy
New TV size war and INX OEM Partners strategy

Gen 8/8.5
- Korea(SDC, LGD)
- China(BOE, CSOT, CEC-Panda)
- Taiwan(AUO, INX)
- Japan(Panasonic, Sharp)
- Capacity 1874K
- Main Products
  - 32”/49”/55”/65”(MMG)
  - Trying 43” by MMG

V.S

Gen 8.6
- Taiwan(INX)
- China(CEC-Panda, CEC-IRICO, HKC)
- Capacity 420K(Future)
- Main Products
  - 45”/50”/58”/65”/58”

Gen 10.5
- China(BOE, CSOT)
- Global total
- Capacity 180K(Future)
- Main products
  - 43”/49”/65”/75”
Power shift happening in TFT-LCD industry

- Korean leads TFT-LCD industry past 15 years.
- Looks like “No any longer”, Power shift is on going.
- Samsung defocus TFT-LCD business. Who will take leadership here?
- Korean needs to find a way to keep their position in this industry. That’s AMOLED.
Status of AMOLED panel suppliers

- Small and medium AMOLED industry
  > Only Samsung Display reached mass production of Quad HD & flexible AMOLED, placing it ahead of others for more than three years. To overcome the lack of core technology and experience, suppliers should avoid the exclusive patent of Samsung.

- Large AMOLED industry
  > Only LG Display reached mass production of Ultra HD larger than 65 inches, but it is suffering from low yield rate and high cost. To overcome these issues, suppliers should develop innovative manufacturing processes.

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### AMOLED Panel Supplier’s Development Status

<table>
<thead>
<tr>
<th>Secure core technology</th>
<th>Move to flexible AMOLED by 2018</th>
<th>Reduce manufacturing cost</th>
<th>Differentiate with flexible / large OLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve Technology (need more core tech.)</td>
<td>Improve Yield Rate (need more experience)</td>
<td>Application Target (Monitor, Wearables)</td>
<td>Increase Capacity (Flexible, TV panel)</td>
</tr>
<tr>
<td>INX, Truly, CPT JOLED, JDI, CSOT</td>
<td>BOE, Tianma, EDO, GVO</td>
<td>AUO, Sony</td>
<td>SDC, LGD</td>
</tr>
</tbody>
</table>

**R&D** | **Pilot run** | **MP** (Niche market) | **MP** | **Source:** IHS | **© 2016 IHS**
China targets high-end OLED technologies

- China makers also working on high-end OLED technologies such as printing OLED, QD OLED.
- China is rising market, equipment & material suppliers have interest in.

China Maker's high-end OLED technology R&D alliance

World's largest generation 11 line (10 sqm)
Oxide semiconductor, Cu process
POA, Super GOA tech
QD OLED Printing tech
43", 65", 70" (21:9), 75" LCD displays
Ultra-large public displays as well as OLED displays

Source: IHS
Thank you for your attentions

- 2016.11.2
- Yoonsung Chung
- Director, Displays
- IHS Technology