CMOS Image Sensors in Automotive Industry

ADAS & AUTONOMOUS Are Taking Off

Aug. 2017
KINGPAK’s statements of its current expectations are forward-looking statements subject to significant risks and uncertainties and actual results may differ materially from those expressed or implied in these forward-looking statements for a variety of reasons, including but not limited to, among other things: the cyclical nature of our industry; our dependence on introducing new products on a timely basis; our dependence on growth in the demand for our products; our ability to compete effectively; our ability to successfully expand our capacity; our dependence on key personnel; general economic and political conditions, including those related to the electronic device industries; possible disruptions in commercial activities caused by natural and human-induced disasters, including terrorist activity and armed conflict; and fluctuations in foreign currency exchange rates.

Except as required by law, we undertake no obligation to update any forward-looking statement, whether as a result of new information, future events, or otherwise.
Index:

I  Overall CMOS Image Sensor (CIS) Market
II  Automotive CIS Market
III  Security & Surveillance Market
IV  Key Customers Analysis
V  Kingpak Introduction
VI  More Challenges from Automotive Industry Requirements
VII  Kingpak Competition Analysis
VIII  Kingpak Performance update
1. Overall CIS CAGR in Revenue(Y2016-2022) ~10.5%
2. Automotive CAGR in Revenue(Y2016-2022) ~23%
3. Security CAGR in Revenue(Y2016-2022) ~18%
2. CMOS Image Sensor Market (in unit)

<table>
<thead>
<tr>
<th>Year</th>
<th>Industrial/Space/Defence</th>
<th>Security</th>
<th>Medical</th>
<th>Automotive</th>
<th>Computing</th>
<th>Consumer</th>
<th>Mobile</th>
<th>Total</th>
<th>YoY Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>21</td>
<td>6</td>
<td>1</td>
<td>-</td>
<td>402</td>
<td>91</td>
<td>1,273</td>
<td>1,793</td>
<td>20%</td>
</tr>
<tr>
<td>2011</td>
<td>23</td>
<td>9</td>
<td>1</td>
<td>4</td>
<td>475</td>
<td>102</td>
<td>1,536</td>
<td>2,149</td>
<td>35%</td>
</tr>
<tr>
<td>2012</td>
<td>25</td>
<td>12</td>
<td>1</td>
<td>9</td>
<td>653</td>
<td>111</td>
<td>2,089</td>
<td>2,900</td>
<td>26%</td>
</tr>
<tr>
<td>2013</td>
<td>26</td>
<td>17</td>
<td>1</td>
<td>21</td>
<td>842</td>
<td>115</td>
<td>2,633</td>
<td>3,656</td>
<td>18%</td>
</tr>
<tr>
<td>2014</td>
<td>28</td>
<td>31</td>
<td>1</td>
<td>43</td>
<td>871</td>
<td>114</td>
<td>3,241</td>
<td>4,330</td>
<td>6%</td>
</tr>
<tr>
<td>2015</td>
<td>31</td>
<td>66</td>
<td>2</td>
<td>86</td>
<td>786</td>
<td>83</td>
<td>3,520</td>
<td>4,992</td>
<td>8%</td>
</tr>
<tr>
<td>2016</td>
<td>34</td>
<td>100</td>
<td>2</td>
<td>96</td>
<td>728</td>
<td>87</td>
<td>3,906</td>
<td>5,492</td>
<td>11%</td>
</tr>
<tr>
<td>2017e</td>
<td>37</td>
<td>130</td>
<td>3</td>
<td>146</td>
<td>694</td>
<td>98</td>
<td>4,396</td>
<td>6,040</td>
<td>10%</td>
</tr>
<tr>
<td>2018e</td>
<td>41</td>
<td>161</td>
<td>3</td>
<td>208</td>
<td>650</td>
<td>105</td>
<td>4,879</td>
<td>6,595</td>
<td>9%</td>
</tr>
<tr>
<td>2019e</td>
<td>45</td>
<td>195</td>
<td>3</td>
<td>258</td>
<td>622</td>
<td>116</td>
<td>5,367</td>
<td>7,149</td>
<td>8%</td>
</tr>
<tr>
<td>2020e</td>
<td>49</td>
<td>233</td>
<td>4</td>
<td>304</td>
<td>594</td>
<td>130</td>
<td>5,850</td>
<td>7,665</td>
<td>7%</td>
</tr>
<tr>
<td>2021e</td>
<td>53</td>
<td>274</td>
<td>4</td>
<td>342</td>
<td>578</td>
<td>143</td>
<td>6,285</td>
<td>8,090</td>
<td>6%</td>
</tr>
<tr>
<td>2022e</td>
<td>58</td>
<td>321</td>
<td>4</td>
<td>376</td>
<td>564</td>
<td></td>
<td>6,624</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Market TAM:
1. 5.0B units market in 2016 & should reach 8.0B units by 2022
2. CAGR(2016~2022) in Unit: 8.5%

'16~’22 CAGR in Unit for Automotive(26%) & Security(21%)
Automotive will become 2nd largest segment by Y2018

‘16~’22 CAGR in Revenue for Automotive(23%) & Security(18%)
### 4. Who Are Major Players & Ranking (by Revenue)

<table>
<thead>
<tr>
<th>Rank (Previous)</th>
<th>Company</th>
<th>2015</th>
<th>2016</th>
<th>YoY (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (1)</td>
<td>Sony</td>
<td>$3960</td>
<td>$4,858</td>
<td>23%</td>
</tr>
<tr>
<td>2 (2)</td>
<td>Samsung</td>
<td>$1,850</td>
<td>$2,126</td>
<td>15%</td>
</tr>
<tr>
<td>3 (3)</td>
<td>Omnivision</td>
<td>$1,250</td>
<td>$1,437</td>
<td>15%</td>
</tr>
<tr>
<td>4 (5)</td>
<td>ON Semi</td>
<td>$747</td>
<td>$717</td>
<td>-4%</td>
</tr>
<tr>
<td>5 (4)</td>
<td>Panasonic</td>
<td>$336</td>
<td>$387</td>
<td>15%</td>
</tr>
<tr>
<td>6 (7)</td>
<td>Canon</td>
<td>$404</td>
<td>$360</td>
<td>-11%</td>
</tr>
<tr>
<td>7 (8)</td>
<td>SK Hynix</td>
<td>$325</td>
<td>$310</td>
<td>-5%</td>
</tr>
<tr>
<td>8 (10)</td>
<td>ST Micro</td>
<td>$200</td>
<td>$290</td>
<td>45%</td>
</tr>
<tr>
<td>9 (9)</td>
<td>Galaxycore</td>
<td>$275</td>
<td>$286</td>
<td>4%</td>
</tr>
<tr>
<td>10 (11)</td>
<td>Pixart</td>
<td>$170</td>
<td>$181</td>
<td>6%</td>
</tr>
<tr>
<td>11 - Hamamatsu</td>
<td>$96</td>
<td>$132</td>
<td>38%</td>
<td></td>
</tr>
<tr>
<td>12 (12)</td>
<td>Pixelpus</td>
<td>$93</td>
<td>$85</td>
<td>-9%</td>
</tr>
<tr>
<td>13</td>
<td>Other</td>
<td>$542</td>
<td>$429</td>
<td>-21%</td>
</tr>
</tbody>
</table>

**2015** $10,248M

**2016** $11,598M

- **SONY** #1 in CCD Image sensor; leading BSI technology for Apple
- **SAMSUNG** #1 Smartphone market share, plus leading Semiconductor Technology
- **OVT** Working with TSMC, 1st BSI release for Apple, leading in low-end market
- **ON SEMI** Merged Aptina in 2014, with a focus on Automobile & Security areas
Index:

Ⅰ Overall CMOS Image Sensor (CIS) Market

Ⅱ Automotive CIS Market

Ⅲ Security and Surveillance Market

Ⅳ Key Customers Analysis

Ⅴ Kingpak Introduction

Ⅵ More Challenges from Automotive Industry Requirements

Ⅶ Kingpak Competition Analysis

Ⅷ Kingpak Performance update
1. CMOS Automotive Camera Market (M units)

1. From 2017~2022 growth should be back to a ~25.6% CAGR in volume
2. Some cars will require +10 cameras.
2. CMOS Automotive Top 10

- After 3 years of intense growth, the CIS automotive market is now highly visible in the CIS industry.
- ON Semi is the dominant player in this market followed by Omnivision.
- Sony’s acquisition of Toshiba’s CIS business will modify the power balance in the coming years.
1. The average timeline for camera module house to certify the system is ~ 1 to 2 years.
2. These Tier1 & Tier2 module/system makers have qualified Kingpak System/Products.
4. CMOS Automotive Market Trend

AUTOMOTIVE CAMERA MARKET TREND

Probably up to 10 cameras per car

- Different Sensor Technologies are used to assist the driver
  - Radar
  - Lidar
  - Visible & NIR cameras (CIS)
  - Infrared cameras
  - Ultrasound

- Up to 10 cameras per car
  - Rear view
  - Surround view (x4)
  - Front view
  - Night front view
  - In-car driver view
  - In-car passenger view
  - Hand motion controller

1. Different Sensor Technology, including NIR, Infrared Cameras, etc...
2. Up to 10 Cameras per car
1. **Y2016 (Current):** Surround View (Display)
2. **Y2020:** Assistance for Driving Monitoring *(Tesla)*
3. **After Y2020:** more cameras due with Semi-Auto/ADAS demand
6. Automotive Market Trend for ADAS

**Automotive Market Trend**

Cameras have changed from feature to key enabling technology for ADAS

**Adoption (Built-in vs. Timing) Rate:**

1. **3-5 years:** 1-4ea per car for Surround View Display
2. **7-10 years:** 4-8ea for Assistance (Driving Monitoring)
3. **Over 10 years:** 8-10ea per car for Semi-Auto (ADAS)
## 7. Automotive Market Trend

### AUTOMOTIVE IMAGING - DEVICE SEGMENTATION

<table>
<thead>
<tr>
<th>Control</th>
<th>Device/Application</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gesture recognition</td>
<td>3D camera</td>
</tr>
<tr>
<td></td>
<td>Driver monitoring</td>
<td>Camera</td>
</tr>
<tr>
<td>For AV &amp; ADAS</td>
<td>3D sensing</td>
<td>LIDAR</td>
</tr>
<tr>
<td></td>
<td>Night vision</td>
<td>LWIR camera</td>
</tr>
<tr>
<td>For display</td>
<td>Forward ADAS</td>
<td>Camera</td>
</tr>
<tr>
<td></td>
<td>Mirror replacement</td>
<td>Camera</td>
</tr>
<tr>
<td></td>
<td>360° surround</td>
<td>Camera</td>
</tr>
<tr>
<td></td>
<td>Rearview/Backup</td>
<td>Camera</td>
</tr>
<tr>
<td></td>
<td>Dash/Blackbox</td>
<td>Camera</td>
</tr>
</tbody>
</table>

1. 3D imaging & sensing still has limited applications in the automotive industry.
2. Trying to penetrate the Automotive industry.
Index:

I  Overall CMOS Image Sensor (CIS) Market
II  Automotive CIS Market
III  Security & Surveillance Market
IV  Key Customers Analysis
V  Kingpak Introduction
VI  More Challenges from Automotive Industry Requirements
VII  Kingpak Competition Analysis
VIII  Kingpak Performance update
CMOS sensor sales for security systems and surveillance applications are expected to grow by a CAGR in Unit ~+21.0% (2016-2022)
Security CAGR in Revenue(Y2016-2022)≈18%
Index:

Ⅰ Overall CMOS Image Sensor (CIS) Market
Ⅱ Automotive CIS Market
Ⅲ Security & Surveillance Market
★Ⅳ Key Customers Analysis
Ⅴ Kingpak Introduction
Ⅵ More Challenges from Automotive Industry Requirements
Ⅶ Kingpak Competition Analysis
Ⅷ Kingpak Performance update
A. ON Semiconductor: 1. Biz Strategies

- **Headquarters:** Phoenix, AZ
- **Employees:** ~23,000 globally
- **Revenue:** ~$3.5Bn\(^{(1)}\)
- **Market Capitalization:** ~$4.2Bn\(^{(2)}\)
- **Ticker:** ON
- **Founded:** Spun-off from Motorola 1999, IPO 2000

Remark: Strategies in Biz
- a. Investing in Automobile & Industrial Sectors to drive business Growth.
- b. #1 market share & expanding technology lead in automobile sectors.
A. ON Semiconductor: 1. Biz Strategies

AUTOMOTIVE GROWTH DRIVERS - #1 MARKET SHARE AND GROWING

- **传感器市场占有率**
  - **ON** 70%
  - **Others** 30%

- **ADAS图像传感器市场占有率**
  - **ON** 50%
  - **SONY** 14%
  - **Omnivision** 16%
  - **Toshiba** 12%
  - **Molex** 3%
  - **Gentex** 2%

- **ON Semiconductor**

ISG AUTOMOTIVE REVENUE

- **2014**: $150m
- **2015**: $250m
- **2016**: $350m

FY2014 revenue includes full year Aptina revenue. Source: TSR, IHS, Gartner and ON Semiconductor
## 2. ON Semiconductor -- Top 20

### 2016F Top 20 Semiconductor Sales Leaders ($M, Including Foundries)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Intel*</td>
<td>U.S.</td>
<td>52,144</td>
<td>56,313</td>
<td>8%</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Samsung</td>
<td>South Korea</td>
<td>42,043</td>
<td>43,535</td>
<td>4%</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>TSMC (1)</td>
<td>Taiwan</td>
<td>26,439</td>
<td>29,324</td>
<td>11%</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>Qualcomm (2)</td>
<td>U.S.</td>
<td>16,008</td>
<td>15,436</td>
<td>-4%</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>Broadcom Ltd.* (2)</td>
<td>Singapore</td>
<td>15,183</td>
<td>15,332</td>
<td>1%</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>SK Hynix</td>
<td>South Korea</td>
<td>16,649</td>
<td>14,234</td>
<td>-15%</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>Micron</td>
<td>U.S.</td>
<td>14,483</td>
<td>12,842</td>
<td>-11%</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>TI</td>
<td>U.S.</td>
<td>12,112</td>
<td>12,349</td>
<td>2%</td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td>Toshiba</td>
<td>Japan</td>
<td>9,429</td>
<td>10,922</td>
<td>16%</td>
</tr>
<tr>
<td>10</td>
<td>9</td>
<td>NXP*</td>
<td>Europe</td>
<td>10,563</td>
<td>9,498</td>
<td>-10%</td>
</tr>
<tr>
<td>11</td>
<td>13</td>
<td>MediaTek (2)</td>
<td>Taiwan</td>
<td>6,699</td>
<td>8,610</td>
<td>29%</td>
</tr>
<tr>
<td>12</td>
<td>11</td>
<td>Infineon</td>
<td>Europe</td>
<td>6,916</td>
<td>7,343</td>
<td>6%</td>
</tr>
<tr>
<td>13</td>
<td>12</td>
<td>ST</td>
<td>Europe</td>
<td>6,873</td>
<td>6,944</td>
<td>1%</td>
</tr>
<tr>
<td>14</td>
<td>17</td>
<td>Apple (2,3)</td>
<td>U.S.</td>
<td>5,531</td>
<td>6,493</td>
<td>17%</td>
</tr>
<tr>
<td>15</td>
<td>14</td>
<td>Sony</td>
<td>Japan</td>
<td>6,263</td>
<td>6,466</td>
<td>3%</td>
</tr>
<tr>
<td>16</td>
<td>18</td>
<td>Nvidia (2)</td>
<td>U.S.</td>
<td>4,696</td>
<td>6,340</td>
<td>35%</td>
</tr>
<tr>
<td>17</td>
<td>16</td>
<td>Renesas</td>
<td>Japan</td>
<td>5,682</td>
<td>5,751</td>
<td>1%</td>
</tr>
<tr>
<td>18</td>
<td>15</td>
<td>GlobalFoundries* (1)</td>
<td>U.S.</td>
<td>5,729</td>
<td>5,085</td>
<td>-11%</td>
</tr>
<tr>
<td>19</td>
<td>19</td>
<td>ON Semi*</td>
<td>U.S.</td>
<td>4,866</td>
<td>4,858</td>
<td>0%</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>UMC (1)</td>
<td>Taiwan</td>
<td>4,464</td>
<td>4,455</td>
<td>0%</td>
</tr>
</tbody>
</table>

| Total Including Foundries | — | 272,772 | 282,130 | 3% |
| Total Without Foundries   | — | 236,140 | 243,266 | 3% |

Remark:
Rank in 2016: Top 20

*(1) Pure-play foundry
*(2) Fabless supplier
*(3) Custom processors for internal use made by TSMC and Samsung foundry services.
*2016 and 2015 sales include Intel/Altera, Broadcom/Avago, NXP/Freescale, GlobalFoundries/IBM, and ON/Fairchild sales for all of 2015 and 2016.
Source: Companies, IC Insights’ Strategic Reviews Database
3. ON Semiconductor
CMOS in Automotive/Security

Automotive

PC Core Power (DCDC) #1
Industrial ASIC #1
Notebook Adapters (ACDC) #1
White Goods IPM #2
Adaptive Front Lighting #1

Automotive Image Sensors #1
Security Image Sensors #1
Audiology DSP Systems #1
Protection #1
GP Op Amps #2
Linear VREG #1

Image Sensors

Power Conversion & Motor Control

Wireless Devices

Industrial IoT

Sources: iSuppli, IMS Research, Strategy Analytics, Fuji Chimera Research, ON Semiconductor Business Units and Corporate Marketing
B. SONY :
1. Image sensor “Battle of the Giants”: Sony invests $4B. What does it mean for the CIS industry?

Sony’s Core:
1. Sony CCD’s Technology Transfer; Pioneer in BSI;
2. The **new stacked sensors** are presented as the next evolution step, right after BSI.
3. Capa expansion plan ~45% from 60Kpcs to 87Kpcs per month from Sept. 2016.
B. SONY:

1. **Image sensor “Battle of the Giants”:** Sony invests $4B. What does it mean for the CIS industry?

Sony’s Core:

1. Sony CCD’s Technology Transfer; **Pioneer in BSI**;
2. The **new stacked sensors** are presented as the next evolution step, right after BSI.
3. Capa expansion plan ~45% from 60Kpcs to 87Kpcs per month from Sept. 2016.
1. Sony owns about 35% market share in CIS.
2. Now 3% share in automotive; *to be No 1 in automotive sensors*" by the time self-driving cars are expected to hit the roads in early to mid-2020s.
3. Sony’s new sensor is capable of capturing high-resolution color images in light conditions as low as 0.005 lux, a level equivalent to that of a moonless night and one that is far below illumination levels under a star-filled night sky. New generation (higher resolution) products are also under mass production already.
1. Towerjazz Panasonic Semiconductor Company is a joint venture 51% owned by Tower Semiconductor and 49% owned by Panasonic.
2. TPSCo manufactures CMOS to meet the growing demand in high end photography, Security/surveillance and Automotive applications.
D. OmniVision Technology Inc.

Headquartered in Santa Clara, Calif., OmniVision currently has 19 offices in 12 different countries, including a design center and testing facility in Shanghai, China.

OmniVision is a fabless company and uses the foundry capability of TSMC.

Acquired by Investor Consortium Hua Capital in January 2016

1. A fabless Company and uses the foundry capability of TSMC.
2. aCSP is now for Automotive Market, but migrating to aBGA.
I Overall CMOS Image Sensor (CIS) Market
II Automotive CIS Market
III Security & Surveillance Market
IV Key Customers Analysis
V Kingpak Introduction
VI More Challenges from Automotive Industry Requirements
VII Kingpak Competition Analysis
VIII Kingpak Performance Update
1. Kingpak IPs

**Remark**

1. World#1 CSP Package Mass Production for DRAM
2. Y2000 started Micro SD PIP package, Y2005 World#1 MP
3. Most CMOS Image Sensor package IP Company

- ~550 patent applications
- ★ More Ips under Filing

**Technology Field Distribution (Application count)**

- CMOS: 329
- BGA / CSP: 98
- Memory card: 61
- Flip chip: 14
- Process/Test: 22
2. Kingpak Product & Service

a. Package Solutions
b. Kingpak Dedicated Reconstructed Assembly

1. • Class 10 clean room for CMOS Image Sensors
2. • Auto/Visual Inspection
3. • Polish Grinding
4. • Laser Grooving
5. • Auto/Visual Inspection
c. Kingpak Final Test

1. • Industrial Standard System

2. • In-house Developed System
Remark:
The average timeline for tier 1 or 2 automotive integrator to certify is 1.5 to 2 years. Plus CIS package qualification=> The total timeline takes 3 ~4 years.
4. Entry Barriers for Package

Stage 1: IP Patent
- Over 500 Patents, and 62% focus on CMOS

Stage 2: Quality System
- System certify: TS16949; ISO14001
- 0 dppm target: 6 sigma implement
- Passed Tier 1 customer audit

Stage 3: Process Control
- High Level Clean room setup: Class 10
- Good experience & Know-How at Particle control

Stage 4: Technical Supporting
- Fully Turn-Key Solution
- Small Pixel size Handling experience
- Package development Know-How & Profile

Stage 5: Management Team
- Over 15 years CMOS experience Elite
- Long term Relationship w/ Suppliers
Index:

I Overall CMOS Image Sensor (CIS) Market
II Automotive CIS Market
III Security & Surveillance Market
IV Key Customers Analysis
V Kingpak Introduction
★VI More Challenges from Automotive Industry Requirements
VII Kingpak Competition Analysis
VIII Kingpak Performance update
1. Image Application for Automotive

Image sensors applied from short to long distance

Source: Yole
2. Automotive Sensing Requirement Trend

Low luminance, 3D, and Real time will be the mainstream.

Source: Yole
3. Automotive Sensor Resolution Trend

Moving forward to 2.0M and 3.0M or even higher solution

Remark:
Moving forward to 2.0/3.0M is much faster than the migration from 0.3M to 1.3M.

Source: Toshiba
4. Safety Enhancement for ADAS / Autonomous Car

Importance of Grade 2 -> Grade 1 migration

2016 starting 2020 booming

Source: Samtec’16
5. Automotive Sensor Technology & Requirements

**End-Customer Specification**
- High sensitivity
- Better form factor
- High resolution
- High dynamic range
- Fast frame rate
- Fast processing
- Low power consumption
- Depth sensing
- Global shutter
- Multi / Hyperspectral

**Chip Design / FAB Requirement**
- Large sensor area
- Back side illumination (BSI)
- 3D stacked BSI
- 3D stacked hybrid BSI
- 3D stacked with Dram
- Pixel sharing schemes
- Through silicon via (TSV)

**Assembly Requirement**
- Smaller form factor
- Smaller dam space
- Particle / Blemish reduction
- Coating glass
- High reliability (G2 -> G1)
- Chip scale packaging

Source: Yole
6. KINGPAK Package Solution for Stacked BSI Wafer

- Challenge to design window / process / reliability
- More advanced and unique structural design
- Scaling down design window

CSP’s weakness for stacked BSI wafer:
- Limited space for structural design
- Coating glass application not allowed
- G2 reliability only
Index:

Ⅰ Overall CMOS Image Sensor (CIS) Market
Ⅱ Automotive CIS Market
Ⅲ Security & Surveillance Market
Ⅳ Key Customers Analysis
Ⅴ Kingpak Introduction
Ⅵ More Challenges from Automotive Industry Requirements
★Ⅶ Kingpak Competition Analysis
Ⅷ Kingpak Performance update
## 1.1 Competition Technologies & Analysis

<table>
<thead>
<tr>
<th>Strength</th>
<th>iBGA</th>
<th>xx BGA</th>
<th>CSP</th>
<th>CLCC</th>
<th>COB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Image Quality</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>High Speed Design</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Dimension</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Package Cost</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Thermal Performance</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Cost</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weakness</th>
<th>iBGA</th>
<th>xx BGA</th>
<th>CSP</th>
<th>CLCC</th>
<th>COB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Reliability</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Image Quality</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Package Cost</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Module Reliability</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Dimension</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Reliability</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Module Yield</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Cycle Time</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>iBGA</th>
<th>xx BGA</th>
<th>CSP</th>
<th>CLCC</th>
<th>COB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating glass</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Embedded</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Electrical</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Performance</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>12 inch wafer</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Lower package cost</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>for 12 inch CSP</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Easy Package Tech.</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>After Market</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Threat</th>
<th>iBGA</th>
<th>xx BGA</th>
<th>CSP</th>
<th>CLCC</th>
<th>COB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower package cost</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>for 12 inch CSP</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Coating Glass</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>High speed</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Limitation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Less material</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Supplier</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Yield control</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Potential Competitors:

- KINGPAK
- Xintec
- TERRASEM
- LITEON
<table>
<thead>
<tr>
<th>Package Size</th>
<th>iBGA</th>
<th>Tiny iBGA</th>
<th>XinTSV</th>
<th>XinPac</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7.5 x 7.5 mm</td>
<td>7 x 7 mm</td>
<td>6.2 x 6.2 mm</td>
<td>6.2 x 6.2 mm</td>
</tr>
<tr>
<td></td>
<td>5.6 um x 5.6 um</td>
<td>5.6 um x 5.6 um</td>
<td>5.6 um x 5.6 um</td>
<td>5.6 um x 5.6 um</td>
</tr>
<tr>
<td>Module Size</td>
<td>8 x 8 mm (estimate)</td>
<td>7.5 x 7.5 mm (estimate)</td>
<td>7.5 x 7.5 mm (estimate)</td>
<td>7.5 x 7.5 mm (estimate)</td>
</tr>
<tr>
<td>Package Reliability Level</td>
<td>AEC Q-100 Grade 2</td>
<td>AEC Q-100 Grade 1</td>
<td>AEC Q-100 Grade 2</td>
<td>AEC Q-100 Grade 2</td>
</tr>
<tr>
<td>Board Level Reliability</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (under-fill)</td>
<td>Yes (under-fill)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No, W/O Under-fill</td>
<td>No, W/O Under-fill</td>
</tr>
<tr>
<td>Cost</td>
<td>Middle</td>
<td>Low</td>
<td>High</td>
<td>Middle</td>
</tr>
</tbody>
</table>
Index:

I Overall CMOS Image Sensor (CIS) Market
II Automotive CIS Market
III Security & Surveillance Market
IV Key Customers Analysis
V Kingpak Introduction
VI More Challenges from Automotive Industry Requirements
VII Kingpak Competition Analysis
VIII Kingpak Performance update
**KINGPAK Q2 2017 Consolidated Statement of Financial Information (QoQ)**

<table>
<thead>
<tr>
<th>Unit: NTD K</th>
<th>Q1-2016</th>
<th>%</th>
<th>Q2-2016</th>
<th>%</th>
<th>Q3-2016</th>
<th>%</th>
<th>Q4-2016</th>
<th>%</th>
<th>Q1-2017</th>
<th>%</th>
<th>Q2-2017</th>
<th>%</th>
<th>Q1 o Q2</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue</strong></td>
<td>708,997</td>
<td></td>
<td>566,544</td>
<td></td>
<td>522,523</td>
<td></td>
<td>559,219</td>
<td></td>
<td>500,908</td>
<td></td>
<td>536,585</td>
<td></td>
<td>7.1%</td>
<td></td>
</tr>
<tr>
<td><strong>Gross profit</strong></td>
<td>231,193</td>
<td>32.61</td>
<td>168,173</td>
<td>29.68</td>
<td>123,817</td>
<td>23.70</td>
<td>181,191</td>
<td>32.40</td>
<td>171,971</td>
<td>34.33</td>
<td>178,302</td>
<td>33.23</td>
<td>3.7%</td>
<td></td>
</tr>
<tr>
<td><strong>Operating income</strong></td>
<td>153,357</td>
<td>21.63</td>
<td>106,104</td>
<td>18.73</td>
<td>62,924</td>
<td>12.04</td>
<td>107,459</td>
<td>19.22</td>
<td>109,018</td>
<td>21.76</td>
<td>102,669</td>
<td>19.13</td>
<td>-5.8%</td>
<td></td>
</tr>
<tr>
<td><strong>EPS</strong></td>
<td>2.83</td>
<td></td>
<td>2.03</td>
<td></td>
<td>1.43</td>
<td></td>
<td>3.15</td>
<td></td>
<td>2.06</td>
<td></td>
<td>2.12</td>
<td></td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td><strong>ROA</strong></td>
<td>28.38%</td>
<td></td>
<td>22.91%</td>
<td></td>
<td>19.62%</td>
<td></td>
<td>25.26%</td>
<td></td>
<td>20.33%</td>
<td></td>
<td>18.89%</td>
<td></td>
<td>-1.45%</td>
<td></td>
</tr>
<tr>
<td><strong>ROE</strong></td>
<td>46.63%</td>
<td></td>
<td>42.94%</td>
<td></td>
<td>35.65%</td>
<td></td>
<td>38.17%</td>
<td></td>
<td>29.85%</td>
<td></td>
<td>32.34%</td>
<td></td>
<td>2.49%</td>
<td></td>
</tr>
<tr>
<td><strong>Debt/Assets</strong></td>
<td>38.79%</td>
<td></td>
<td>52.30%</td>
<td></td>
<td>49.68%</td>
<td></td>
<td>29.27%</td>
<td></td>
<td>34.94%</td>
<td></td>
<td>51.23%</td>
<td></td>
<td>16.29%</td>
<td></td>
</tr>
<tr>
<td><strong>Current ratio</strong></td>
<td>147.33%</td>
<td></td>
<td>110.86%</td>
<td></td>
<td>126.11%</td>
<td></td>
<td>149.31%</td>
<td></td>
<td>158.07%</td>
<td></td>
<td>121.77%</td>
<td></td>
<td>-36.30%</td>
<td></td>
</tr>
<tr>
<td><strong>Quick ratio</strong></td>
<td>127.02%</td>
<td></td>
<td>98.42%</td>
<td></td>
<td>114.76%</td>
<td></td>
<td>127.61%</td>
<td></td>
<td>140.54%</td>
<td></td>
<td>112.34%</td>
<td></td>
<td>-28.21%</td>
<td></td>
</tr>
</tbody>
</table>

a. Better product portfolio by more auto engagement in 2017
b. Auto product migrate to 1.3 and 2M

EPS*: retroactive adjustment
**KINGPAK Q2 2017 Consolidated Statement of Financial Information**

<table>
<thead>
<tr>
<th></th>
<th>Q3-2016</th>
<th>Q4-2016</th>
<th>Q1-2017</th>
<th>Q2-2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>522,523</td>
<td>559,219</td>
<td>500,908</td>
<td>536,585</td>
</tr>
<tr>
<td>Gross profit</td>
<td>123,817</td>
<td>181,191</td>
<td>171,971</td>
<td>178,302</td>
</tr>
<tr>
<td>EPS</td>
<td>1.43</td>
<td>3.15</td>
<td>2.06</td>
<td>2.12</td>
</tr>
</tbody>
</table>

**GM %**

|       | 24% | 32% | 34% | 33% |

- a. revenue pick up again by 1.3M launch
- b. better and better EPS QOQ
KINGPAK Q2 2017 Consolidated Statement of Financial Information

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross profit (K)</td>
<td>156,733</td>
<td>107,587</td>
<td>188,758</td>
<td>207,555</td>
<td>231,193</td>
<td>168,173</td>
<td>123,817</td>
<td>181,191</td>
<td>171,971</td>
<td>178,302</td>
</tr>
<tr>
<td>Gross margin (%)</td>
<td>22%</td>
<td>21%</td>
<td>28%</td>
<td>29%</td>
<td>33%</td>
<td>30%</td>
<td>24%</td>
<td>32%</td>
<td>34%</td>
<td>33%</td>
</tr>
</tbody>
</table>
Automotive revenue in Q2 2017 will hit a record high!!!!!!
Automotive sector is going to dominate our business and keep growing