CMOS Image Sensors in Automotive Industry
ADAS & AUTONOMOUS Are Taking Off

May. 2019
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.
I  CIS Market Outlook
II  Automotive CIS Market Outlook
III  Security & Surveillance CIS Market Outlook
IV  Kingpak Major Customers & Landscape
V   Kingpak’s Growth Potential & Driver
VI  Overview of Kingpak
VII  Technology Competition & Analysis
VIII Kingpak Performance Updated
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1. Overall CIS CAGR in Revenue(Y2017-2023) ~9.4%
2. Automotive CAGR in Revenue(Y2017-2023) ~16%
3. Security CAGR in Revenue(Y2017-2023)~15%
Market TAM:
1. 5.2B units market in 2017 & should reach 8.2B units by 2023
2. CAGR(2017~2023) in Unit: 7.7%  
   '17~’23 CAGR in Unit for Automotive(19%) & Security(19%)
3. ‘18 vs ‘19 YoY in Unit for Automotive(26%) & Security(21%)
### 4. CMOS Image Sensor Market (in $M)

Automotive will become 2\textsuperscript{nd} largest segment by Y2020

‘17~’23 CAGR in Revenue for Automotive(16%) & Security(15%)

‘18~’19 YoY in Revenue for Automotive(23%) & Security(18%)
5. Who Are Major Players & Ranking (by Revenue)

<table>
<thead>
<tr>
<th>Rank (Previous)</th>
<th>Company</th>
<th>2016 (in $M)</th>
<th>2017 (in $M)</th>
<th>YoY(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sony</td>
<td>$4,848</td>
<td>$5,690</td>
<td>21%</td>
</tr>
<tr>
<td>2</td>
<td>Samsung</td>
<td>$2,126</td>
<td>$2,727</td>
<td>28%</td>
</tr>
<tr>
<td>3</td>
<td>Omnivision</td>
<td>$1,437</td>
<td>$1,480</td>
<td>3%</td>
</tr>
<tr>
<td>4</td>
<td>On Semi</td>
<td>$717</td>
<td>$768</td>
<td>7%</td>
</tr>
<tr>
<td>5</td>
<td>STMicro</td>
<td>$290</td>
<td>$669</td>
<td>131%</td>
</tr>
<tr>
<td>6</td>
<td>Panasonic</td>
<td>$387</td>
<td>$433</td>
<td>12%</td>
</tr>
<tr>
<td>7</td>
<td>Canon</td>
<td>$360</td>
<td>$382</td>
<td>6%</td>
</tr>
<tr>
<td>8</td>
<td>SK Hynix</td>
<td>$310</td>
<td>$319</td>
<td>3%</td>
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<tr>
<td>9</td>
<td>Galaxycore</td>
<td>$286</td>
<td>$252</td>
<td>-12%</td>
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<tr>
<td>10</td>
<td>Hamamatsu</td>
<td>$132</td>
<td>$152</td>
<td>15%</td>
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<tr>
<td>11</td>
<td>Smartsens</td>
<td>$52</td>
<td>$129</td>
<td>148%</td>
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<tr>
<td>12</td>
<td>ams</td>
<td>$80</td>
<td>$88</td>
<td>10%</td>
</tr>
<tr>
<td>13</td>
<td>Other</td>
<td>$573</td>
<td>$617</td>
<td>8%</td>
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</tbody>
</table>

*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
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Remark:
1. On semi is No1 in automotive with 49% share, furthermore, 55+% On OEM sector.
2. Sony, as No1 share in CIS, will be our 2nd largest customer in auto 2018.
3. Omnivision will be very promising customer in 2019.
3. Automotive Camera Supply Chains

The average timeline for camera module house to certify the system is ~ 1 to 2 years.

These Tier1 & Tier2 module/system makers have qualified Kingpak System/Products.
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2. CMOS Security/Surveillance Top 10

Remark:
1. Kingpak continues to support high tier customer in security and surveillance customers.
2. Continues to support and focus on high-end products sector.
3. Security CAGR in Revenue(Y2017-2023)~15%
# Security / Surveillance Supply Chain

## Security Camera Map

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Package</th>
<th>Optics</th>
<th>Major</th>
<th>Minor</th>
</tr>
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<tbody>
<tr>
<td>OmniVision</td>
<td>XinTec</td>
<td>LARGAN</td>
<td>AXIS Communications</td>
<td>BAC/LEI</td>
</tr>
<tr>
<td>ON Semiconductor</td>
<td>Aptina</td>
<td>BOSCH</td>
<td>PELCO</td>
<td>PHILIPS</td>
</tr>
<tr>
<td>SONY</td>
<td>SONY</td>
<td>SHARP</td>
<td>PELCO</td>
<td>AREVA</td>
</tr>
<tr>
<td>Samsung</td>
<td>KYOCERA</td>
<td>VIVOTEK</td>
<td>THALES</td>
<td>Dallmeier</td>
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<tr>
<td>Pixim</td>
<td>Fujinon</td>
<td>Martec</td>
<td>FALLON</td>
<td>ZAVIO</td>
</tr>
<tr>
<td>Clarity</td>
<td>OIARON</td>
<td>MOBOTIX</td>
<td>VERINT</td>
<td>tyco</td>
</tr>
<tr>
<td>Point Pixel</td>
<td>KINGPAK</td>
<td>G&amp;G</td>
<td>VERINT</td>
<td>I&amp;E</td>
</tr>
<tr>
<td>Viimagic</td>
<td>ChipMOS</td>
<td>D-Link</td>
<td>VERINT</td>
<td>Honeywell</td>
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資料來源：Kingpak Management
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c. Supply Chain Landscape - CAR maker name plate
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Ⅶ Technology Competition & Analysis
Ⅷ Kingpak Performance Updated
1. Tapping the 19% CAGR growth in automotive camera market driven by ADAS and autonomous vehicle.

2. Leveraging Kingpak’s 55-65% global share in assembly/testing of automotive camera sensors. The global share is over 70% in OEM market.
2. Automation Levels - Roadmap

Source: Yole
3. Automotive Imaging - Device Segmentation

### Automotive Imaging - Device Segmentation

<table>
<thead>
<tr>
<th>For AD</th>
<th>Device/Application</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Driver monitoring</td>
<td>Camera</td>
</tr>
<tr>
<td></td>
<td>Gesture recognition</td>
<td>3D camera</td>
</tr>
<tr>
<td>For ADAS</td>
<td>3D sensing</td>
<td>Lidar</td>
</tr>
<tr>
<td></td>
<td>Forward ADAS</td>
<td>Mono/stereo camera</td>
</tr>
<tr>
<td></td>
<td>Night vision</td>
<td>Thermal camera</td>
</tr>
<tr>
<td>For Display</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>

Source: Yole
4. CIS Anticipating More Applications & Sensor Fusion

Longer term, more automotive image sensor for 3D cameras, short to long distance, Infra-red

Source: Yole
5. CIS Migration from 0.3MP to 1.0/2.0/3.0MP

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

Source: Toshiba

Remark:
Automotive camera sensor resolution migration (Upgrading from 0.3M to 1.3/2.0/3.0MP)
EU NCAP Drives In-Cabin Sensing Opportunity

More than ninety percent of road accidents are caused by “human mistakes”

Euro NCAP Road Map 2025

- **Primary Safety**
  - Driver Monitoring (DM) (2020),
  - Automatic Emergency Steering (2020, 2022),
  - Autonomous Emergency Braking (2020, 2022),
  - Vehicle to Vehicle Data Exchange and Vehicle to Infrastructure (2024)

- China to match EU NCAP standards


Source: Affectiva
7. Regulation Untied Stimulating E-Mirror Opportunity

- Japan Automobile Manufacturers’ Association (JAMA) allowed mirrorless cars in 2016
- Lexus digital side-view monitor debuts on the new ES in October 2018
- Regulation to be untied soon in EU and US

Source: Toyota
8. Auto Market Trend for ADAS & Autonomous

AUTOMOTIVE MARKET TREND
Cameras have changed from feature to key enabling technology for ADAS

ADAS
- Collision avoidance
- Pedestrian detection
- Adaptive speed control
- Highway line keeping

Semi-auto
- Night vision
- Cross traffic detection
- Fatigue warning
- Headlight control
- Traffic sign recognition
- Line departure warning
- Blind spot detection

Assist
- 360° surround view
- Dash camera recorder
- Rear view camera

Feature

10+ years adoption rate
5 to 10+ Cameras
7 to 0 years adoption rate
4 to 8 Cameras + advanced image analysis
3 to 5 years adoption rate
1 to 4 Cameras for Display

©2015 | www.yole.fr | Camera Module Industry

ADAS to Autonomous vehicle – Increasing number of camera sensors per vehicle
9. Automotive Market Trend

AUTOMOTIVE MARKET TREND

Tesla’s eight-camera configuration

A similar configuration could be seen on 1/3 of all new vehicles by 2023

Source: Yole
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a. Overview of Kingpak: Product & Services

1. Kingpak is an OSAT focusing on CIS (CMOS Image Sensor) for Auto.
2. Kingpak has 55-65% of global market share in auto camera sensors outsourced Packaging & Testing.
b-1 Product & Service (Package Solutions)
c. 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**

~705 patent applications filed

More IPs under Filing
d. Automotive Supply Chain Certification

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.
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Entry Barriers for Package

**Stage 1: IP Patent**
- Over 700 Patents, and 77% 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
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## KINGPAK Q1 2019 Consolidated Statement of Financial Information (QoQ)

**Unit**: NTD K

|                    | Q1-2017 | %     | Q2-2017 | %     | Q3-2017 | %     | Q4-2017 | %     | Q1-2018 | %     | Q2-2018 | %     | Q3-2018 | %     | Q4-2018 | %     | Q1-2019 | %     | Q1 o Q4 |
|--------------------|---------|-------|---------|-------|---------|-------|---------|-------|---------|-------|---------|-------|---------|-------|---------|-------|---------|-------|
| **Revenue**        | 500,908 |       | 536,585 |       | 530,791 |       | 584,113 |       | 572,498 |       | 594,884 |       | 572,786 |       | 538,069 |       | 623,097 |       | 15.8%   |
| **Gross profit**   | 171,971 | 34.33 | 178,302 | 33.23 | 167,968 | 31.64 | 209,417 | 35.85 | 199,576 | 34.86 | 193,557 | 32.54 | 191,347 | 33.41 | 179,374 | 33.34 | 206,325 | 33.11 | 15.0%   |
| **Operating income** | 109,266 | 21.81 | 102,669 | 19.13 | 106,298 | 20.03 | 160,957 | 27.56 | 147,080 | 25.69 | 125,464 | 21.09 | 127,672 | 22.29 | 112,808 | 20.97 | 140,101 | 22.48 | 24.2%   |
| **EPS**            | 2.06    |       | 2.12    |       | 2.14    |       | 2.43    |       | 2.00    |       | 3.16    |       | 2.11    |       | 2.59    |       | 2.31    |       | -0.28   |
| **ROA**            | 20.37%  |       | 18.91%  |       | 17.99%  |       | 17.03%  |       | 12.39%  |       | 18.65%  |       | 17.94%  |       | 17.99%  |       | 19.91%  |       | 1.92%   |
| **ROE**            | 29.85%  |       | 32.34%  |       | 30.94%  |       | 30.83%  |       | 25.47%  |       | 38.31%  |       | 31.81%  |       | 31.09%  |       | 27.37%  |       | -3.72%  |
| **Debt/Assets**    | 34.94%  |       | 51.23%  |       | 50.99%  |       | 54.39%  |       | 51.40%  |       | 49.05%  |       | 28.71%  |       | 25.05%  |       | 30.32%  |       | 5.27%   |
| **Current ratio**  | 158.07% |       | 121.77% |       | 137.62% |       | 152.02% |       | 156.14% |       | 128.22% |       | 173.48% |       | 199.95% |       | 187.40% |       | -12.55% |
| **Quick ratio**    | 140.54% |       | 112.34% |       | 129.35% |       | 144.42% |       | 147.93% |       | 115.53% |       | 151.10% |       | 170.39% |       | 163.93% |       | -6.47%  |
# KINGPAK Q1 2019 Consolidated Statement of Financial Information

<table>
<thead>
<tr>
<th></th>
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<tr>
<td><strong>Revenue</strong></td>
<td>500,908</td>
<td>536,585</td>
<td>530,791</td>
<td>584,113</td>
<td>572,498</td>
<td>594,884</td>
<td>572,786</td>
<td>538,069</td>
<td>623,097</td>
</tr>
<tr>
<td><strong>Gross profit</strong></td>
<td>171,971</td>
<td>178,302</td>
<td>167,968</td>
<td>209,417</td>
<td>199,576</td>
<td>193,557</td>
<td>191,347</td>
<td>179,374</td>
<td>206,325</td>
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<tr>
<td><strong>EPS</strong></td>
<td>2.06</td>
<td>2.12</td>
<td>2.14</td>
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<td>3.16</td>
<td>2.11</td>
<td>2.59</td>
<td>2.31</td>
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<tr>
<td><strong>GM %</strong></td>
<td>34.33%</td>
<td>33.23%</td>
<td>31.64%</td>
<td>35.85%</td>
<td>34.86%</td>
<td>32.54%</td>
<td>33.41%</td>
<td>33.34%</td>
<td>33.11%</td>
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Unit : NTD K

Unit : NTD
KINGPAK Q1 2019 Consolidated Statement of Financial Information

Unit: NTD K

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<tr>
<th>Quarter</th>
<th>Gross Profit</th>
<th>Gross Margin</th>
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<tbody>
<tr>
<td>Q1-2015</td>
<td>156,7</td>
<td>22.25</td>
</tr>
<tr>
<td>Q2-2015</td>
<td>107,5</td>
<td>21.50</td>
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<tr>
<td>Q3-2015</td>
<td>188,7</td>
<td>28.42</td>
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<td>Q4-2015</td>
<td>207,5</td>
<td>32.61</td>
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<td>Q1-2016</td>
<td>231,1</td>
<td>32.18</td>
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<td>Q1-2017</td>
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<td>179,3</td>
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Unit: %

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<tr>
<td>Q1-2019</td>
<td>206.3</td>
<td>32.18</td>
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KINGPAK Q1 2019 Business Segment (In Revenue)

Unit: NTD in Million

- 1Q 2019 YoY +25%
  For Automotive in Revenue.
Automotive sector is going to dominate our business and keep growing
Thank you