IntelliEPI Inc. (Cayman)
Intelligent Epitaxy Technology
Company Introduction

- Founding: 1/1/1999
- Technical Team former experience: TI, NASA, AT&T Bell Lab
- Factory: Richardson, TX, USA

- Business Model: **MBE Epitaxial Wafer Foundry for III-V Compound Semiconductor**

- Main Products:
  * **GaAs epi-wafers**
    - High frequency electronic devices
      - cell phone switch, car collision avoidance radar, non-mobile devices
    - Optoelectronic devices
      - VCSEL, PD(GaAs- PIN)
  
  * **InP epi-wafers**
    - High frequency electronic devices
      - 5G testing equipment, 5G PA
    - Optoelectronic devices
      - PD(PIN/APD ) , LD driver, TIA

  * **GaSb epi-wafers (IR imaging)**
    - security, space technology, thermal photo voltaic
IET Position in Industry

Substrate (GaAs, InP, GaSb)

Epi Wafer (GaAs, InP, GaSb)

Wafer Processing

Packaging

Mobile Devices
- Cell phone, tablet
- Wearing devices

Non-mobile Devices
- Cable TV, Satellite
- Wi-Fi, base station
- Car electronics, collision avoidance radar
- Space, defense
- RFID, medical
- Intelligent energy system
- Testing and metrology

Optoelectronics
- Transceiver module

Sumitomo, AXT

IET, IQE, VPEC

WIN, AWSC, TrueLight, Luxnet, Source

IDM: Skyworks, Qorvo, Avogo
### III-V Compound Semiconductor Product Matrix

<table>
<thead>
<tr>
<th>Applications</th>
<th>RF and microwave</th>
<th>High Speed Digital</th>
<th>Optoelectronics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RF components</td>
<td>OC768-40Gbps</td>
<td>Fiber optic network light sources</td>
</tr>
<tr>
<td>in handsets</td>
<td>network</td>
<td>OC192-10Gbps</td>
<td>and Photo-detectors</td>
</tr>
<tr>
<td>Automotive radar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense related</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Device Structure      |                  |                    |                                      |
| (Red in Production mode) | GaAs pHEMT   | InP SHBT/DHBT       | GaAs PIN/APD                        |
|                       | GaAs mHEMT      | InP HEMT            | InP PIN/APD                         |
|                       | InP HEMT        | GaAs mHEMT          | QWIP                                 |
|                       | InP HBT         | GaAsSb DHBT         | Diode laser                         |
|                       |                  |                    | Type-II SLS                          |
|                       |                  |                    | Modulator                            |
Main Products

- **GaAs epi-wafers**
  - S and Q company (pHEMT structure): non-mobile devices, Cable TV, Satellite, Wi-Fi, base station, Car electronics, collision avoidance radar, Space, defense, RFID, medical, Intelligent energy system, Testing and metrology
  - U company (pHEMT structure): car collision avoidance radar
  - Potential Market: VCSEL for gesture recognition (VR, AR, MR)

- **InP epi-wafers**
  - K company (HBT): high frequency testing equipment
  - S company (HBT): high frequency electronics, LD driver
  - Optoelectronic: PD (PIN/APD), (10G PON, Data Center)
  - Potential Market: 5G cell phone PA
Main Products

**GaSb epi-wafers: IR imaging**

- Government contract: FPA key material: security, space, special applications
- Commercial: night vision, security
- New Market: InSb and CZT substrates for IR applications

![GaSb single crystal](image)

- Earth surface scan image from NASA with FPA
- Focal plan array image
  - *T2SLS epi-structure*
- Focal Plan Array (FPA)
- GaSb epi wafers
High definition IR image
Data center provides service to LAN and WAN. The switches (S) connect users (U) to servers (C) and storage (D) so that the users can access to the server and have the data stored at the storage. Switches are basically optical transceiver modules.
### InP/GaAs Market-Data Center

<table>
<thead>
<tr>
<th>Port</th>
<th>Links</th>
<th>Fibers/Connectors</th>
<th>Limitations</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>40Gb, 850nm multimode</td>
<td>4 X 10Gb, parallel</td>
<td>8 OM3/4, MTP/MPO</td>
<td>100-125m</td>
<td>Manage fibers in groups of 4</td>
</tr>
<tr>
<td>40 Gb, 1300 nm singlemode</td>
<td>4 X 10Gb, CWDM</td>
<td>2 OS1/OS2, SC or LC</td>
<td>10, 40 km</td>
<td>Premises singlemode</td>
</tr>
<tr>
<td>40 Gb, 1550 nm singlemode</td>
<td>1 X 40Gb</td>
<td>2 OS1/OS2, SC or LC</td>
<td>2 km</td>
<td>Premises singlemode</td>
</tr>
<tr>
<td>100 Gb, 850nm multimode</td>
<td>10 X 10Gb, parallel</td>
<td>20 OM3/4, MTP/MPO</td>
<td>100-125m</td>
<td>Manage fibers in groups of 10 or 12?</td>
</tr>
<tr>
<td>100Gb. 1300 nm singlemode</td>
<td>4 X 25Gb, CWDM</td>
<td>2 OS1/OS2, SC or LC</td>
<td>10, 40 km</td>
<td>Premises singlemode</td>
</tr>
<tr>
<td>800G, Intel SPT, 1300 nm multimode</td>
<td>32 X 25Gb/s</td>
<td>64 special MM fibers, custom 64 fiber expanded beam connector - MXC</td>
<td>300 m</td>
<td>Proprietary fiber and connector, 64 fiber cables, prefab only</td>
</tr>
</tbody>
</table>

- Wavelength 850nm (Multi Mode, MM)→ GaAs VCSEL, GaAs PIN
- Wavelength 1300nm, 1550nm (Single Mode, SM)→ InP LD, InP PD(PIN/APD)
100G = 25GX4 transceiver modules

Global web-scale intra-data center optical transceivers

Source: Ovum

15M units
InP Market-10G PON (EPON, GPON, XG-PON)
InP application for 10G transceiver module and above

Transceiver module

Ethernet MAC → SPP5200 (SFP+) → Ethernet MAC
10Gb/s SFI electrical signal

Transmitter LD

1 module needs up to 3~4 InP devices

Receiver PD (PIN, APD)

Ethernet MAC → SPP5200 (SFP+) → Ethernet MAC
10Gb/s optical signal

10Gb/s SFI electrical signal

(Sumitomo, SPR5200 Series)
China United Telecommunications Co. Ltd announced public bidding for 10G PON products on 5/10.


C114讯 5月10日消息
据来自中国联通的官方消息显示，中国联通已经对2015-2016年10G PON产品启动公开招标。

本次集采分两个标段，分别是10G EPON和XG PON1。

其中，10G EPON OLT集采约3345台，OLT PON口数约40886个(局端)，MDU约209.6万线(用户端)；XG PON1 OLT集采约6962台，OLT PON口数约59891个(局端)，MDU约353.8万线(用户端)。

从数量上看，XG PON1招标数量大幅领先10G EPON。

中国联通此次10G PON集采从规模看也超过了中国电信。
根据中国电信之前的公告，2016年PON设备集采包括10G EPON设备新建OLT端口10万、ONU(含MDU/MTU)宽窄带端口共120万，没有采购XG PON1设备。

中国联通2015年累计投入244亿元，目前已建成全光网络省7个、全光网络地市118个；光纤入户覆盖家庭1.6亿户，较光改前提升1.1倍。
中国联通董事长王晓初指出，中国联通将继续加快光网建设和宽带提速，在北方十省全部实现全光网络，提前1年实现城区100M、农村光纤到村的国家“提速降费”目标。据悉，中国联通2016年目标光纤覆盖规模达2亿户，光纤用户规模达到7600万户。

作者：刘定洲 来源：C114中国通信网
- **4G cell phone PA**
  - GaAs HBT epi wafers, < 3~5G Hz

- **5G cell phone PA**
  - spec. not defined, speed: 50~100 times faster, >20G Hz
  - 10 seconds for 2 Hr. HD movie down loading
  - many technical barriers to overcome from 4G to 5G
  - Options for frequency eligible
    - GaAs (pHEMT), or InP (HBT)
    - InP HBT device performance much superior to GaAs(pHEMT), but cost higher due to lower supplied quantity
    - as quantity increase, price will down to acceptable level
    - lower cost InP/GaAs substrate emerging
  - InP HBT will be the material for 5G cell phone PA

- **IET has strong advantage on InP HBT with its MBE technology**
  - n-type doping 10 times higher than MOCVD counterpart
  - precise control of thickness and uniformity
- North America and Europe ~ 90%
- Japan market focus on datacomm and InP related products
- One of the only two major MBE foundries left in the world.
- Sole supplier to UMS (car collision avoidance radar chip maker)
- Sole supplier to Keysight Technology (5G high frequency test equipment start shipping in Q3/2015)
- Significant advantage on PD (PIN/APD) for 10G PON and data center market
- Significant advantage on 5G cell phone PA
### Revenue and Gross Margin

**Unit: NT$**

<table>
<thead>
<tr>
<th>Q3-13</th>
<th>Q4-13</th>
<th>Q1-14</th>
<th>Q2-14</th>
<th>Q3-14</th>
<th>Q4-14</th>
<th>Q1-15</th>
<th>Q2-15</th>
<th>Q3-15</th>
<th>Q4-15</th>
<th>Q1-16</th>
<th>Q2-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>$135,484</td>
<td>$131,703</td>
<td>$122,747</td>
<td>$152,878</td>
<td>$208,504</td>
<td>$171,486</td>
<td>$207,892</td>
<td>$224,008</td>
<td>$236,131</td>
<td>$189,253</td>
<td>$244,573</td>
</tr>
<tr>
<td>Op. Profit</td>
<td>$39,732</td>
<td>$14,969</td>
<td>$20,848</td>
<td>$12,490</td>
<td>$39,348</td>
<td>$37,368</td>
<td>$41,776</td>
<td>$65,101</td>
<td>$56,642</td>
<td>$21,313</td>
<td>$34,928</td>
</tr>
<tr>
<td>Q G.R.</td>
<td>-19.9%</td>
<td>-2.8%</td>
<td>-6.8%</td>
<td>24.5%</td>
<td>36.4%</td>
<td>-17.8%</td>
<td>21.2%</td>
<td>7.8%</td>
<td>5.4%</td>
<td>-19.9%</td>
<td>22.3%</td>
</tr>
<tr>
<td>G. Profit</td>
<td>52.9%</td>
<td>35.2%</td>
<td>45.3%</td>
<td>31.2%</td>
<td>35.8%</td>
<td>39.6%</td>
<td>36.5%</td>
<td>44.5%</td>
<td>38.7%</td>
<td>28.7%</td>
<td>34.1%</td>
</tr>
</tbody>
</table>

**Unit: NT$**

**Graph:** Revenue, Op. Profit, G. Margin
## Income Statement - 2016Q2

**(Currency: TWD '000s)**

<table>
<thead>
<tr>
<th></th>
<th>2015 Q2</th>
<th>%</th>
<th>2016 Q1</th>
<th>%</th>
<th>2016 Q2</th>
<th>%</th>
<th>QoQ</th>
<th>YoY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sales Revenue</strong></td>
<td>$224,008</td>
<td></td>
<td>$231,432</td>
<td></td>
<td>$244,573</td>
<td></td>
<td>5.7%</td>
<td>9.2%</td>
</tr>
<tr>
<td><strong>Cost of Goods Sold</strong></td>
<td>-124,225</td>
<td></td>
<td>-152,498</td>
<td></td>
<td>-151,020</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gross Margin</strong></td>
<td>99,783</td>
<td>44.5%</td>
<td>78,934</td>
<td>34.1%</td>
<td>93,553</td>
<td>38.3%</td>
<td>18.5%</td>
<td>-6.2%</td>
</tr>
<tr>
<td><strong>G&amp;A Expenses</strong></td>
<td>-34,682</td>
<td>15.5%</td>
<td>-44,006</td>
<td>19.0%</td>
<td>-41,006</td>
<td>16.8%</td>
<td>-6.8%</td>
<td>18.2%</td>
</tr>
<tr>
<td><strong>Operating Income</strong></td>
<td>65,101</td>
<td>29.1%</td>
<td>34,928</td>
<td>15.1%</td>
<td>52,547</td>
<td>21.5%</td>
<td>50.4%</td>
<td>-19.3%</td>
</tr>
<tr>
<td><strong>Non-operation gain/(Loss)</strong></td>
<td>-12,115</td>
<td></td>
<td>2,179</td>
<td></td>
<td>1,356</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Financial Charge</strong></td>
<td>(4,060)</td>
<td></td>
<td>(11)</td>
<td></td>
<td>-1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Net Income before Income Tax</strong></td>
<td>48,926</td>
<td></td>
<td>37,096</td>
<td></td>
<td>53,902</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Income Tax (Expenses)/Gain</strong></td>
<td>-17,885</td>
<td></td>
<td>-13,147</td>
<td></td>
<td>-17,839</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Net Income after Income Tax</strong></td>
<td>$31,041</td>
<td>13.9%</td>
<td>$23,949</td>
<td>10.3%</td>
<td>$36,063</td>
<td>14.7%</td>
<td>50.6%</td>
<td>16.2%</td>
</tr>
<tr>
<td><strong>EPS (Currency: TWD)</strong></td>
<td>$0.98</td>
<td></td>
<td>$0.69</td>
<td></td>
<td>$1.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ROA</strong></td>
<td>2.1%</td>
<td></td>
<td>1.5%</td>
<td></td>
<td>2.2%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ROE</strong></td>
<td>2.6%</td>
<td></td>
<td>1.6%</td>
<td></td>
<td>2.5%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Balance Sheet - 2016Q2

#### (Currency: TWD '000s)

<table>
<thead>
<tr>
<th></th>
<th>2015/6/30</th>
<th>2016/3/31</th>
<th>2016/6/30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>金额</td>
<td>%</td>
<td>金额</td>
</tr>
<tr>
<td><strong>Cash and Cash Equivalent</strong></td>
<td>284,191</td>
<td>19.4%</td>
<td>365,845</td>
</tr>
<tr>
<td>Accounts Receivable-net</td>
<td>105,824</td>
<td>7.2%</td>
<td>128,990</td>
</tr>
<tr>
<td>Inventory</td>
<td>131,937</td>
<td>9.0%</td>
<td>144,753</td>
</tr>
<tr>
<td>Other Current Assets</td>
<td>262,751</td>
<td>17.9%</td>
<td>275,930</td>
</tr>
<tr>
<td><strong>Total Current Assets</strong></td>
<td>784,703</td>
<td>53.4%</td>
<td>915,518</td>
</tr>
<tr>
<td>Fixed Assets</td>
<td>309,661</td>
<td>21.1%</td>
<td>563,018</td>
</tr>
<tr>
<td>Intangible Assets</td>
<td>56,118</td>
<td>3.8%</td>
<td>50,969</td>
</tr>
<tr>
<td>Other Non-current Assets</td>
<td>318,048</td>
<td>21.7%</td>
<td>40,935</td>
</tr>
<tr>
<td><strong>Total Assets</strong></td>
<td>1,468,530</td>
<td>100.0%</td>
<td>1,570,440</td>
</tr>
<tr>
<td>Current Liabilities</td>
<td>174,463</td>
<td></td>
<td>91,557</td>
</tr>
<tr>
<td>Long-term Liabilities-CB</td>
<td>111,003</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Liabilities</strong></td>
<td>285,466</td>
<td>19.4%</td>
<td>91,557</td>
</tr>
<tr>
<td>Owner's Equity</td>
<td>1,183,064</td>
<td>80.6%</td>
<td>1,478,883</td>
</tr>
<tr>
<td><strong>Total Liabilities and Owner’s Equity</strong></td>
<td>1,468,530</td>
<td>100.0%</td>
<td>1,570,440</td>
</tr>
</tbody>
</table>

- Debt to Total Assets ratio: 19.4% in 2015/6/30, 5.8% in 2016/3/31, 10.6% in 2016/6/30
- Current ratio: 449.8% in 2015/6/30, 999.9% in 2016/3/31, 386.1% in 2016/6/30
- Quick ratio: 368.0% in 2015/6/30, 829.4% in 2016/3/31, 285.4% in 2016/6/30
### Product Mix

<table>
<thead>
<tr>
<th>Product</th>
<th>Year</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016Q1</th>
<th>2016Q2</th>
</tr>
</thead>
<tbody>
<tr>
<td>GaAs</td>
<td>%</td>
<td>62</td>
<td>39.7</td>
<td>35.1</td>
<td>46.7</td>
<td>51.8</td>
<td>53.4</td>
<td>52</td>
</tr>
<tr>
<td>InP</td>
<td>%</td>
<td>17.9</td>
<td>40.2</td>
<td>39.4</td>
<td>31.2</td>
<td>24.8</td>
<td>33.6</td>
<td>40.8</td>
</tr>
<tr>
<td>GaSb and man power</td>
<td>%</td>
<td>11.2</td>
<td>15.6</td>
<td>22.4</td>
<td>21.5</td>
<td>22.8</td>
<td>12.7</td>
<td>6.6</td>
</tr>
<tr>
<td>others</td>
<td>%</td>
<td>9</td>
<td>4.5</td>
<td>3.1</td>
<td>0.6</td>
<td>0.6</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

- 2016 InP significant growth
Forward looking

- **2016~2018 revenue driver**
  - SWKS (GaAs) → IOT
  - UMS (GaAs) → car collision avoidance radar
  - Keysight (InP) → 5G testing equip.
  - Optioelectronic (InP) → PIN/APD for 10G PON, Data Center, LD driver, TIA
  - GaSb-IR → commercial products

- **2016~2020**
  - 5G cell phone PA
MBE Technology Becomes Important

Advantage shows up as frequency and performance demand increase

MOCVD technology

MBE technology takes off

2001年
3G cellphone

2011年
4G cellphone

2015年
Car collision avoidance radar (GaAs pHEMT)

2016年
China start 10G PON InP PD (PIN/APD)

2017年
Gesture recognition GaAs VCSEL

2018年

2020年
5G cellphone PA InP HBT

China start 10G PON

China starts 10G PON.
Thank you!