China 5G Plan and SOI Ecosystem

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Why is China motivated to setup 5G Network in 2020?
Worldwide smart phone sales is saturated. Growth rate is at low single digit.
3G/4G user is saturated in China. Growth rate is at single digit from 2017.
China smart phone sales is 87.5 million units in Q1 2018 and growth rate is -16%.
China is Motivated to Setup 5G Network

**User**
- Users want more speed.
- 4G networks are hard-pressed to meet current user demand.
- In other words, users want to consume more, but experience and speeds are falling short of expectations.

**Carrier**
- OPEX reduction should be a strategic priority for 5G.
- CAPEX as a percentage of carrier revenue has declined from 17% to 12% in last decade.
- OPEX as a percentage of carrier revenue has risen from 62% to 75%.

**5G Network (sub 6GHz)**
- 5G builds on 4G and expands its potential.
- The R15 standard focuses on commercial needs for enhanced mobile broadband (eMBB). It also meets basic needs for uRLLC and mMTC.

**Government**
- Strong support to develop 5G network with the aim to stimulate GDP growth in China.
- Total expected investment is RMB 1.14 trillion (US$ 170 billion).
China Mobile targets commercial use together with China Unicom and Telecom in 2020.
China Mobile Vision – “More than Connecting”

- In 2020 and beyond, China Mobile will pursue the target of "More Than Connecting".
- Establishing a high quality, intelligence network to realize the interconnection of all things.
- Creating a first-class infrastructure to provide professional services to realize the connection between traditional industry and information for Internet +, and enabling unlimited innovation.
- Cooperate with all the partners in the industry to jointly realize the “More Than Connecting” vision in the year of 2020 and beyond.
- Provide the digital services for everything that is connected. These include human, machine, enterprise and information.

Source: China Mobile
Huawei – Work with Industry to Deliver the 5G Mission

- Huawei will work with the industry to deliver the 5G mission.
- 3GPP has completed the standalone R15 5G specification. And 5G spectrum has been made available in some countries. 5G will soon be deployed on a large scale.
- Huawei will also launch a 5G-ready Kirin chip in 2019, and a 5G smartphone in June 2019. These products will allow consumers that want higher speeds to enjoy an incredible 5G experience as soon as possible.
- Huawei is ready to work with industry partners, to invest and to innovate, so that together the industry can succeed in delivering the 5G mission.

Source: Huawei
What is 4G/5G SOI Supply Chain and IC Ecosystem in China?
China 4G/5G SOI Supply Chain

- SOI Material
- SOI Foundry
- Design Service
- RF Component
- System Designer
- Handset Maker
• China smart phone market reaches to 459 million units in 2017. However, growth rate becomes negative for the first time in 9 years.

• China counts for 30% of worldwide market.

• In 2017, Domestic smart phone suppliers counts for 86% of China market.

• Among them, Huawei, Oppo and Vivo are top three suppliers and count for 56% of the China market.
HiSilicon is a global fabless semiconductor and IC design company which is dedicated to comprehensive connectivity and multimedia chipset solutions.

Kirin chip solution is the industry's leading intelligent mobile phone chip solutions.

HiSilicon will launch a 5G-ready Kirin chip in 2019.

Spreadtrum Communications, Inc. ("Spreadtrum") is a fabless semiconductor company that develops mobile chipset platforms for smartphones, feature phones and other consumer electronics products, supporting 2G, 3G and 4G wireless communications standards.

Spreadtrum's customers include global and China-based manufacturers developing mobile products for consumers in China and emerging markets around the world.
2017 Top 10 IC Design/System Company: HiSilicon and Spreadtrum Among the List

<table>
<thead>
<tr>
<th>2017E Rank</th>
<th>Company</th>
<th>Headquarter</th>
<th>2016</th>
<th>2017E</th>
<th>2017/2016 % Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Qualcomm</td>
<td>US</td>
<td>15,414</td>
<td>17,078</td>
<td>11%</td>
</tr>
<tr>
<td>2</td>
<td>Broadcom</td>
<td>Singapore</td>
<td>13,846</td>
<td>16,065</td>
<td>16%</td>
</tr>
<tr>
<td>3</td>
<td>Nvidia</td>
<td>US</td>
<td>6,389</td>
<td>9,228</td>
<td>44%</td>
</tr>
<tr>
<td>4</td>
<td>MediaTek</td>
<td>Taiwan</td>
<td>8,809</td>
<td>7,875</td>
<td>-11%</td>
</tr>
<tr>
<td>5</td>
<td>Apple</td>
<td>US</td>
<td>6,493</td>
<td>6,660</td>
<td>3%</td>
</tr>
<tr>
<td>6</td>
<td>AMD</td>
<td>US</td>
<td>4,272</td>
<td>5,249</td>
<td>23%</td>
</tr>
<tr>
<td>7</td>
<td>HiSilicon</td>
<td>China</td>
<td>3,910</td>
<td>4,715</td>
<td>21%</td>
</tr>
<tr>
<td>8</td>
<td>Xilinx</td>
<td>US</td>
<td>2,311</td>
<td>2,475</td>
<td>7%</td>
</tr>
<tr>
<td>9</td>
<td>Marvell</td>
<td>US</td>
<td>2,407</td>
<td>2,390</td>
<td>-1%</td>
</tr>
<tr>
<td>10</td>
<td>Unigroup (Spreadtrum and RDA)</td>
<td>China</td>
<td>1,880</td>
<td>2,050</td>
<td>9%</td>
</tr>
</tbody>
</table>

- Top 10 Total       -   65,731       73,785      12%
- Other               -   24,694       26,825      9%
- Total Fabless/System - 90,425       100,610     11%

Two Chinese companies, HiSilicon and Unigroup (Spreadtrum and RDA), are among the top 10 fabless IC sales leaders.

Source: IC Insight

In 2017 worldwide fabless sales is around $100 billions and Chinese fabless company counts for 33%.
IC Design Enterprises in China

- **Close Door Policy** (1990-1999)
- **Open Door Policy** (2000-2014)
- **Stimulative Policy** (2015-2020)

Source: PWC
Component Design Company for RF FEM

- **RDA Microelectronics** is a fabless semiconductor company that designs, develops and markets wireless systems-on-chip and radio-frequency semiconductors for cellular, connectivity, and broadcast applications.
- RF FEM products include radio-frequency front end modules, power amplifiers, etc.

- **Smartermicro** is a fabless semiconductor company that designs, develops and provides MMIC, RF and Analog IC.
- The Company's product portfolio currently includes Gain block, GPA, Switch, Power Amplifier, Mixer, and etc.

- **HunterSun** is focused on the development of RF integrated circuit chips, analog integrated circuit chips, and System-on-Chip.
- The product portfolio currently includes wireless communications chips, power management chips, RF front-end modules, etc.

- **Vanchip** is focused on design and development of RF power amplifier for smart phone application.
- Its product includes 2G/3G/4G power amplifier for handset and other smart mobile devices.
### Fund by Central & Local Gov.

<table>
<thead>
<tr>
<th>Province</th>
<th>RMB (billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CICF (central gov.)</td>
<td>138.7</td>
</tr>
<tr>
<td>Beijing</td>
<td>32</td>
</tr>
<tr>
<td>Fujian</td>
<td>66</td>
</tr>
<tr>
<td>Guangdong</td>
<td>15</td>
</tr>
<tr>
<td>Hubei</td>
<td>30</td>
</tr>
<tr>
<td>Hunan</td>
<td>0.25</td>
</tr>
<tr>
<td>Nanjing</td>
<td>51</td>
</tr>
<tr>
<td>Wuxi</td>
<td>20</td>
</tr>
<tr>
<td>Liaoning</td>
<td>10</td>
</tr>
<tr>
<td>Shanxi</td>
<td>30</td>
</tr>
<tr>
<td>Shanghai</td>
<td>50</td>
</tr>
<tr>
<td>Shijiazhuang</td>
<td>10</td>
</tr>
<tr>
<td>Sichuan</td>
<td>12</td>
</tr>
<tr>
<td>Tianjin</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Total RMB Billion</strong></td>
<td><strong>465.2</strong></td>
</tr>
</tbody>
</table>

### By 2017

**USD 74B**

### By 2020

**USD 150B**

(RMB 1 Trillion)

CICF fund is managed by Sino IC Capital.

Source: SEMI
# China Semiconductor Fab and New 300mm Fab Activity

<table>
<thead>
<tr>
<th>No</th>
<th>Province City</th>
<th>Company</th>
<th>New 12” Fab Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Beijing</td>
<td>SMIC</td>
<td>B3 28-14nm</td>
</tr>
<tr>
<td>2</td>
<td>Shanghai</td>
<td>SMIC</td>
<td>12” 28-14nm</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Huali</td>
<td>12” 28-14nm</td>
</tr>
<tr>
<td>4</td>
<td>Wuxi</td>
<td>Huali</td>
<td>12” 65-45nm</td>
</tr>
<tr>
<td>5</td>
<td>Wuhan</td>
<td>YMTC</td>
<td>12” NAND and NOR</td>
</tr>
<tr>
<td>6</td>
<td>Hefei</td>
<td>JingHe</td>
<td>12” line</td>
</tr>
<tr>
<td>7</td>
<td>Fujian</td>
<td>Jinhua</td>
<td>12” memory</td>
</tr>
<tr>
<td>8</td>
<td>Nanjing</td>
<td>TSMC</td>
<td>12” 14nm</td>
</tr>
<tr>
<td>9</td>
<td>Xiamen</td>
<td>UMC</td>
<td>12” line</td>
</tr>
<tr>
<td>10</td>
<td>Dalian</td>
<td>Intel</td>
<td>12” line convert NAND</td>
</tr>
<tr>
<td>11</td>
<td>Chengdu</td>
<td>Global Foundries</td>
<td>12” 22nm FDX</td>
</tr>
<tr>
<td>12</td>
<td>Chongqing</td>
<td>AOS</td>
<td>12” power management</td>
</tr>
</tbody>
</table>

Source: SEMI
China IC Manufacturing: CAGR 15.6% (2008-2017)

Source: CSIA
SMIC is one of the leading foundries in the world, and the largest foundry in China. It provides integrated circuit (IC) foundry and technology services on process nodes from 0.35 micron to 28 nanometer that include logic, mixed-signal/RF CMOS, high voltage, SoC, flash, EEPROM, CIS and LCoS micro-display technology.

HHGrace provides professional and highly value-added foundry services covering technology solutions from 1.0μm to 90nm process nodes. It focuses on advanced and differentiated technologies including eNVM (embedded Non-Volatile Memory), power management IC, power discrete, RF (Radio Frequency), as well as standard logic and mixed-signal.

In China, GF and the Chengdu municipality have formed a partnership to build a fab in Chengdu. The partners plan to establish a 300mm fab to support the growth of the Chinese semiconductor market and to meet accelerating global customer demand for 22FDX. The fab will begin production of mainstream process technologies in 2018 and then focus on manufacturing GF’s commercially available 22FDX process technology, with volume production expected to start in 2019.
What is the Plan from NSIG and Simgui on SOI Material?
National Silicon Industry Group (NSIG): To Support Material Ecosystem in China

Supported by China IC Fund and Shanghai local fund as part of China’s strategy to promote IC industry in material area.

To establish a materials ecosystem to support the growth of the semiconductor industry in China.
Simgui Expands 200mm SOI Capacity to Support RF-SOI Market

- Simgui expands 200mm SOI capacity to 400K per year by 2020.
- Some of RF products will be converted to 300mm SOI.
Simgui to Expand Manufacturing Facility to 300mm SOI

- 300mm Fab construction is completed. Total planned capacity is 800K per year.
Summary

• China is aggressively working on 5G and plans to deploy 5G commercialization in 2020.

• China Mobile will be ready for large scale commercial use of 5G network in 2020. Huawei will be ready on both 5G commercial system and handset in mid 2019.

• 4G/5G SOI supply chain has been setup in China but it is not balanced. It is strong on handset and system design but weak on component design and wafer foundry.

• Chinese government is promoting IC industry including SOI ecosystem. It is expected to invest total of RMB 1 trillion (USD 150 billion) into IC industry by 2020.

• Simgui is focused on 200mm SOI material for RF application. It is planned to expand its facility to 300mm SOI.
For more information
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