Navigating Turbulent Times in the Semiconductor Industry
4C’s

C Covid 19
C Consumer
C Cyber
C Chips
The world is almost back to pre-covid activity levels

The Economist normalcy index*, pre-pandemic level=100

*28-day moving average †Population-weighted average of countries in index excluding China

Sources: The Economist, September 22

WHO declares a pandemic
First clinically approved covid-19 vaccine given
Delta labelled a variant of concern
Omicron labelled a variant of concern

Nigeria 114
Germany 92
World †87
United States 78
China 75

Jan 21
Feb 20
Aug 22
0
20
40
60
80
100
120
140
The Journey of Silicon Semiconductor Value Chain

The semiconductor value chain is truly global and relies on the specialized capabilities of different geographic areas.
The Global Journey of a Smartphone Application Processor

**Design**
- A European firm licenses IP on application processor architecture
- A US EDA firm provides highly sophisticated software for chip design
- A US fabless firm designs (and commercializes) the chip

**Equipment**
- Highly advanced manufacturing equipment is developed by companies in the US, Japan, and Europe, leveraging decades of global R&D efforts

**Materials**
- Silicon dioxide is mined in the US and refined into metallurgical grade silicon
- The Silicon is melted and re-crystallized to form a large single crystal called an ingot by a polysilicon manufacturer in Japan
- The Ingot is sliced into several wafers in South Korea, which are then polished and shipped to a fabrication plant

**Manufacturing**
- A foundry in Taiwan imprints the wafers and with an array integrated circuits "patterned" wafers are stacked and interconnected
- Individual chips are separated and packaged by an OSAT in Malaysia

**Commercialization**
- The chip is selected ("designed in") by a US smartphone OEM to power its new device
- The chip is shipped to the smartphone OEM's assembly partner in China, who incorporates it into a circuit board inside the phone
- The smartphone is sold to a consumer in the US

Intangible flows (software, IP) — Physical flows

Sources: semiconductors.org
No local market or company has all the capabilities required for end-to-end semiconductor design and manufacturing.

Semiconductor sales along the value chain, % share

1. Figures may not sum up to 100% because of rounding
Sources: McKinsey Analysis, Gartner
## Key Players

### Top Buyers of Semiconductors
($B) - 2021

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Company</th>
<th>Amount ($B)</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Apple</td>
<td>$68.3</td>
<td>11.7%</td>
</tr>
<tr>
<td>2</td>
<td>Samsung</td>
<td>$45.8</td>
<td>7.8%</td>
</tr>
<tr>
<td>3</td>
<td>Lenovo</td>
<td>$25.3</td>
<td>4.3%</td>
</tr>
<tr>
<td>4</td>
<td>BBK Electronics</td>
<td>$23.4</td>
<td>4.0%</td>
</tr>
<tr>
<td>5</td>
<td>Dell</td>
<td>$21.1</td>
<td>3.6%</td>
</tr>
<tr>
<td>6</td>
<td>Xiaomi</td>
<td>$17.3</td>
<td>3.0%</td>
</tr>
<tr>
<td>7</td>
<td>Huawei</td>
<td>$15.4</td>
<td>2.6%</td>
</tr>
<tr>
<td>8</td>
<td>HP</td>
<td>$13.8</td>
<td>2.4%</td>
</tr>
<tr>
<td>9</td>
<td>Hon Hai</td>
<td>$8.9</td>
<td>1.5%</td>
</tr>
<tr>
<td>10</td>
<td>HPW</td>
<td>$6.7</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

**Top 10:** $245.8, 42.1%

**Others:** $337.7, 57.9%

**Total:** $583.5, 100.0%

### Top Semiconductors Suppliers
($B) - 2021

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Company</th>
<th>Revenue ($B)</th>
<th>Share</th>
<th>Y/Y Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Samsung</td>
<td>$76.0</td>
<td>13.0%</td>
<td>31.6%</td>
</tr>
<tr>
<td>2</td>
<td>Intel</td>
<td>$73.1</td>
<td>12.5%</td>
<td>0.5%</td>
</tr>
<tr>
<td>3</td>
<td>TSMC</td>
<td>$57.0</td>
<td>9.7%</td>
<td>25%</td>
</tr>
<tr>
<td>4</td>
<td>SK Hynix</td>
<td>$36.3</td>
<td>6.2%</td>
<td>40.5%</td>
</tr>
<tr>
<td>5</td>
<td>Micron</td>
<td>$28.4</td>
<td>4.9%</td>
<td>29.3%</td>
</tr>
<tr>
<td>6</td>
<td>Qualcomm</td>
<td>$26.9</td>
<td>4.6%</td>
<td>52.3%</td>
</tr>
<tr>
<td>7</td>
<td>Broadcom</td>
<td>$18.7</td>
<td>3.2%</td>
<td>19.0%</td>
</tr>
<tr>
<td>8</td>
<td>MediaTek</td>
<td>$17.5</td>
<td>3.0%</td>
<td>58.8%</td>
</tr>
<tr>
<td>9</td>
<td>TI</td>
<td>$16.9</td>
<td>2.9%</td>
<td>24.1%</td>
</tr>
<tr>
<td>10</td>
<td>NVIDIA</td>
<td>$16.3</td>
<td>2.8%</td>
<td>52.7%</td>
</tr>
</tbody>
</table>

**Top 10:** $245.8, 42.1%

**Others:** $257.5, 57.9%

**Total:** $583.5, 100.0%

Sources: Gartner press release (Feb 2022)
Semiconductor IPOs in China vs. Non-China: Capital Invested and Deal Count

Sources: PitchBook
Thank you!