



# WORKSHOP: State of the Global Semiconductor Industry

**PROGRAM MANAGER:** Mr. Travis Mosier, U.S. Department of Commerce

**DATE:** Thursday, August 20, 2020

**TIME:** 4:00 PM – 5:00 PM

## DESCRIPTION

*The global semiconductor industry is experiencing the biggest seismic shift since Gordon Moore predicted the technology's innovation trajectory over 55 years ago. Microchip content across the electronics ecosystem is set to explode as existing and emerging applications create unprecedented opportunities for the industry. However, potential threats are quickly changing the traditional industry growth paradigm and forcing companies to adapt. This session will explore current market conditions, the state of U.S. industry competitiveness, impacts of the coronavirus, China's semiconductor industry development, and other factors affecting the global semiconductor industry.*

## AGENDA

<b>4:00 PM</b>	<b><i>State of the Global Semiconductor Industry</i></b> Mr. Travis Mosier, Office of Health and Information Technologies, Industry & Analysis, International Trade Administration, Dept. of Commerce, Senior International Trade Specialist
<b>4:25 PM</b>	<b><i>Q&amp;A Session</i></b>

**Presentation Concludes: 5:15 PM**

## QUESTIONS

Please contact the ERI Summit mailbox for more information following this workshop at [ERI-Summit@darpa.mil](mailto:ERI-Summit@darpa.mil).



## Housekeeping

- All conversations must remain at Distribution A level (no classified, FOUO, CUI, etc.)
- Microphones will be muted and videos disabled for attendees.
- If you have a question for the speaker, please use the “raise your hand feature”.
  - The facilitator will turn your audio and video on when it is your turn to speak.
  - You will have 60 seconds to ask your question or share your insights.
- If you dial-in separately using your phone, please link the phone connection with your assigned participant ID
  - The participant ID is the 6 numbers seen by clicking on the in the upper left of the Zoom screen
  - On your phone, press #, enter the participant ID, and press #
- If you have any logistical or connection issues:
  - Connect with Zoom support:
    - Zoom Troubleshooting Guidance: <https://support.zoom.us/hc/en-us/sections/200305593-Troubleshooting>
    - Wireless Connection Issues: <https://support.zoom.us/hc/en-us/articles/201362463-Wireless-WiFi-Connection-Issues>
  - Connect with the ERI Team desk via the 6Connex platform

Source: DARPA MTO



# State of the Global Semiconductor Industry An Overview

Presented By: J. Travis Mosier

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U.S. Department of Commerce, International Trade Administration,  
Industry & Analysis, Office of Health and Information Technologies

August 20, 2020



# Agenda

- Global Trends
- U.S. Industry
- Industry Headwinds?
- China Industry
- USG Action
- Q&A

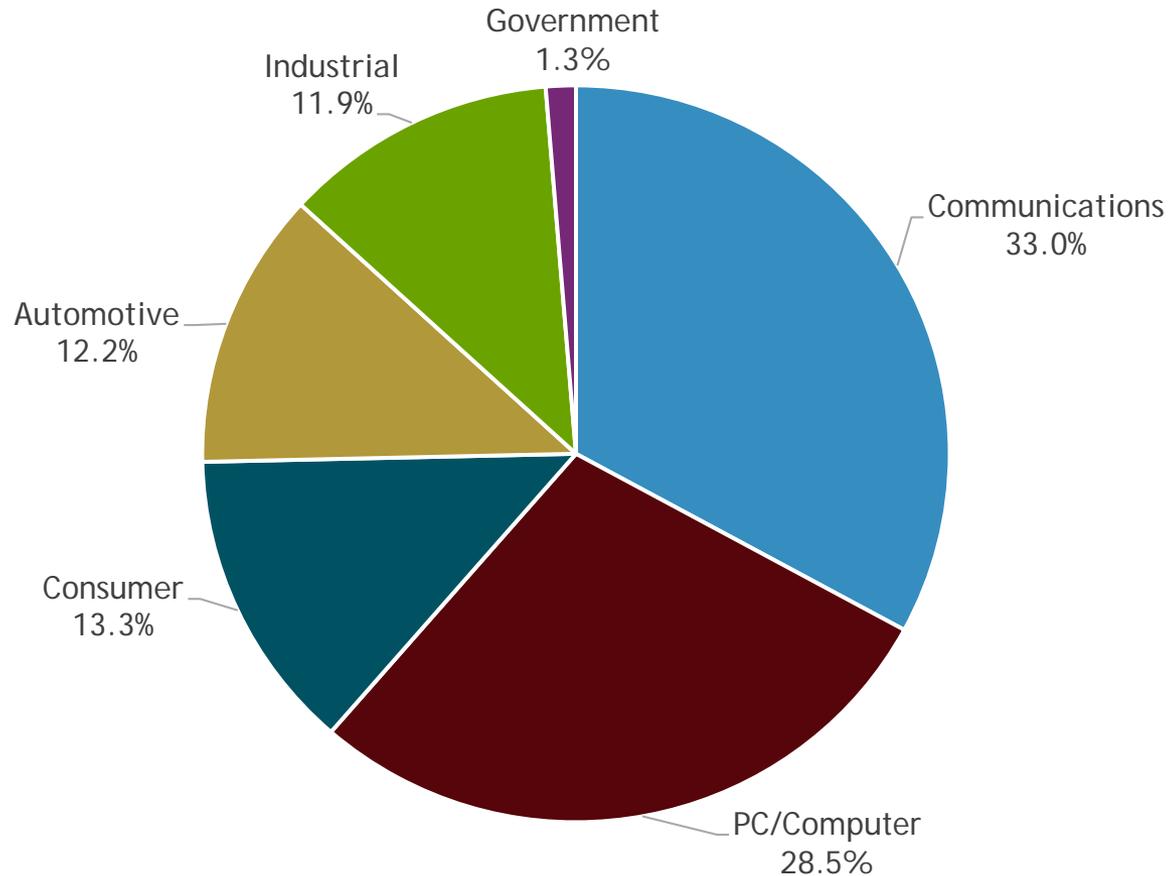


- **2019** global sales - **\$413 billion**
- 12% decrease from 2018 (memory)
- 2020?
  - **Flat** to **marginal growth**
  - **Memory** leads
  - Deceleration of most segments
- Post Pandemic? – The **future** is **bright**

Sources: Semiconductor Industry Association (SIA), World Semiconductor Trade Statistics (WSTS), IC Insights



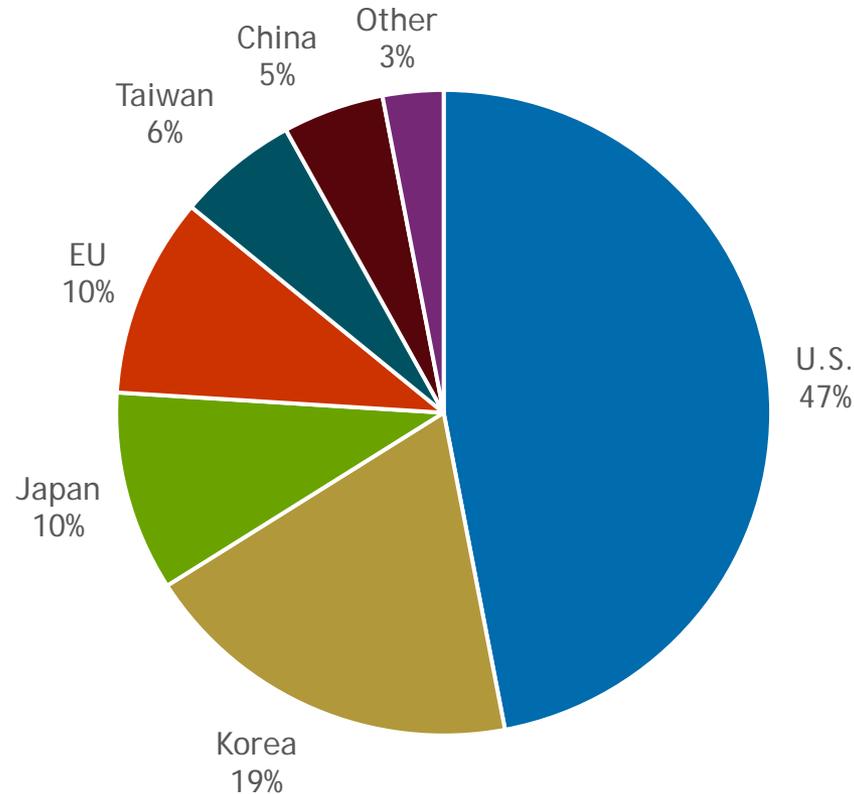
## IC Demand by End Use (2019)



Sources: Semiconductor Industry Association (SIA) and World Semiconductor Trade Statistics (WSTS)



## Share of global sales, based on HQ of seller



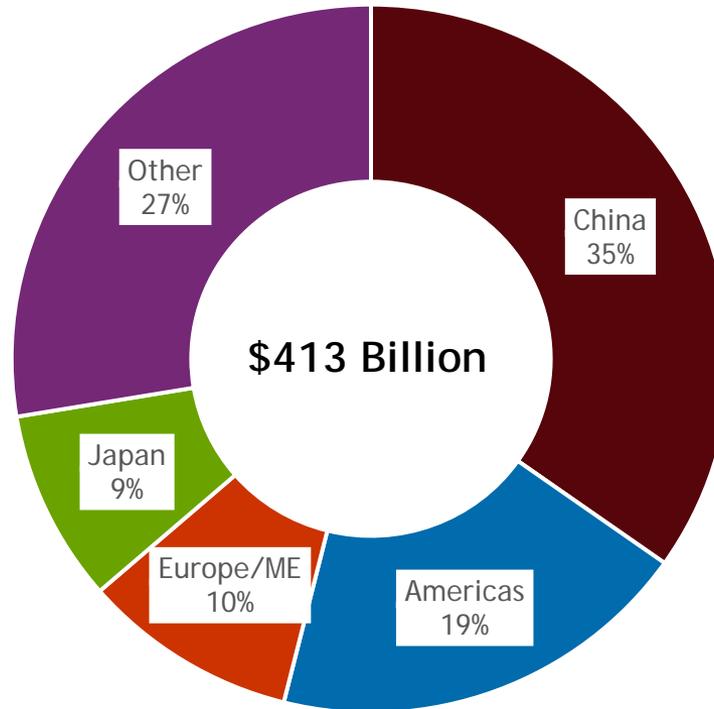
Share based on headquarters of seller, including fabless. Does not include foundry output.

Sources: SIA-World Semiconductor Trade Statistics /IHS/PwC/IC Insights





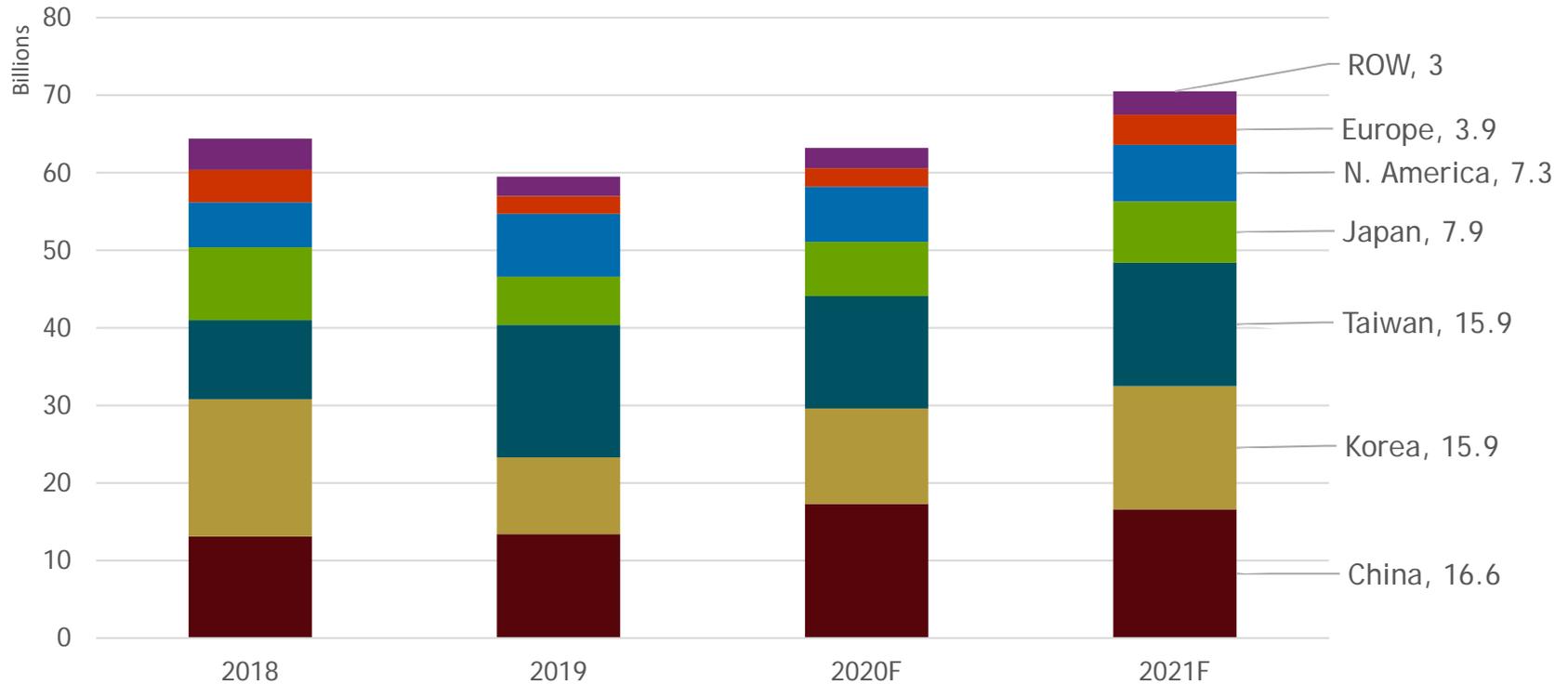
## Destination Market for IC Sales (2019)



Source: World Semiconductor Trade Statistics (June 2020)



## Mid-Year Total Equipment Forecast by Region



Source: SEMI



- **6% increase - \$59.6 billion** in 2019 to projected **\$63.2 billion** in 2020
- **2021** projected record high revenue of **\$70 billion**
- **China** is expected to vault to the **top** in total semiconductor equipment spending **in 2020 and 2021** driven by memory and foundry sectors
- Taiwan and Korea will come in just behind China in spending
- **U.S. and Japanese** equipment firms continue to **dominate** the industry, with 46% and 35% shares

Source: SEMI and Semiconductor Equipment Association of Japan



- **U.S.-based companies** lead the world with **47% market share** in 2019
- **BUT** U.S. companies are **highly globalized** and depend heavily on Asia (China for sales, Taiwan for manufacturing) with operations across the world
- Since the late 90s, the **U.S. has dominated** the semiconductor sector with ~50% market share
- U.S. Capex
  - 45% of all U.S. chip manufacturing done domestically
  - 12% global capex
  - < 6% in China

Source: SIA

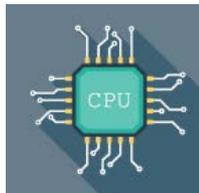


# U.S. Industry - Exports

**U.S. exports** of semiconductors were worth **\$46 billion** in **2019**, **fifth highest** among U.S. exports behind only airplanes, refined oil, crude oil/natural gas and autos. Semiconductors constituted the largest share of U.S. exports of all electronic product exports.

## Top U.S. Exports in 2019 (\$ Bn)

Semiconductors \$46 Billion



Refined Oil \$94 Billion



Crude Oil/Natural Gas \$65 Billion



Aircraft \$125 Billion



Source: SIA, U.S. International Trade Commission



# *U.S. Industry – R&D Picture*

- Rate of **U.S industry R&D semiconductor spending** as % of sales is among the **highest** of any major industrial sector
- Second only to the U.S. pharmaceuticals and biotechnology sector
- 2019, the **United States** was **#1 in R&D spending** among all competitors at 16.4%
- **R&D spending** will only continue to **rise** given increasing chip complexity and abstraction

Source: SIA



# U.S. Industry – Capex

- The **nexus** of semiconductor **manufacturing** is in **Asia**: Taiwan, Korea, China, Japan, Singapore
- 2019 **U.S.-based capex** was **12%** of global wafer capacity, down from 37% in 1990
- 70-75% of capex in U.S. is on older production lines operated by companies including GlobalFoundries
- The **U.S.** is virtually **tied** with **China** in capex
- **China** is projected to have the **largest share** of global **capacity** by **2030** if current trends continue

Source: SIA, Financial Times



# Headwinds? – COVID-19 Impact

- Early on, semiconductor **supply chains** directly impacted by **shutdown** in **Mexico** and **SE Asia**
- Initially predicted **4-10% negative** growth
- Current forecast is **flat to slightly up** - driven by **memory** demand
- Why? **Demand side** is being driven by **IC-heavy industries** like video-conferencing, cloud, IT hardware, etc.
- Notable given collapse of other industries and that the IC industry historically reflects global GDP

Source: SIA, Credit Suisse, IC Insights



- Goal: **Reduce dependency** on foreign semiconductors
- Why? ICs are the **economic, technology, national security cornerstone**
- When? 2014 and 2015 launch, 2030 70% self-sufficiency
- How? **MONEY** (& lots of it) for:
  - M&A
  - Talent
  - Capex
  - Memory
- Next? More of the same plus developing domestic fabless, equipment, EDA, materials and kitchen sink capabilities



# China Industry – Subsidies

- 2014 National IC Fund - \$21 billion, October 2019 - \$29 billion
- **China** maintains its **venture capital model** is **legit**, free from government influence
- **OECD** report **concluded** that this model “may allow governments to continue supporting their domestic industry while **limiting** the **risk** of **WTO challenge\***”
- Central level funding signals local authorities where to invest, amplifying subsidies effect
- 2015-2025 estimated total support \$200 billion

Sources: OECD, China National Enterprise and Credit Information Publicity System, and SIA estimates



- **Early stages** involved **M&A**
  - **Merger of domestic companies** gives scale to compete
  - **Foreign expertise** and **IP** through acquisition and illicit means
- Talent recruitment
  - Foreign engineers
  - **South Korea** and **Taiwan**
  - Inflated **salaries** and **incentives**

Sources: OECD, China National Enterprise and Credit Information Publicity System, and SIA estimates



# China Industry – Capex

- **Largest proportion** of funding by far is to **build capex**
- In 2018, **China** alone accounted for **more than half** of worldwide **construction spending** on fabs
- Total announced **Chinese investment** to build fab capacity **exceeds \$215 billion**
- Government-financed **fabs** could number **70 or more by 2023** compared with  $\approx 25$  now
- **Memory** leads the way
- **World class** in chip **design** for mobile applications (Huawei Kirin)

Sources: Center for Strategic and International Studies, OECD



# China Industry – Memory

- Building **home-grown memory** company to break dominance of Samsung, SK Hynix, and Micron
- Japan/Taiwan model, **memory** as **steppingstone**
- **Memory projects well-funded** and **mature**
- Yangtze Memory Technology Corp emerging as national champion for 3D-NAND Flash
- **\$24 billion** in subsidies
- Volume production of **64-layer 3D NAND** and **128-layer** announced
- During Wuhan lockdown, YMTC engineers given special permission to enter city

Sources: Center for Strategic and International Studies, Nikkei



- Defined by **acceleration** and **widening scope** – “More is Law” in the face of international uncertainty
  - More self-reliance
  - More money and resources for domestic companies
  - More support from provincial and municipal authorities
  - More genuine private sector funding
  - More slices of the semiconductor value chain including, *inter alia*, equipment, design, software, and materials
- Subsidize the adoption of domestic ICs by Chinese electronics companies
- Focus on design weaknesses in CPUs, GPUs, FPGAs and MEMS, seen as key to emerging applications

Sources: Center for Strategic and International Studies, Nikkei



- International Trade Administration Mission – Strengthen the competitiveness of U.S. industry, **promote** trade and **investment**, and ensure fair trade through enforcement of trade laws.



- Bipartisan/Bicameral Bills
  - Creating Helpful Incentives to Produce Semiconductors (CHIPS) for America Act
  - American Foundries Act
- Combined into two possible legislative vehicles
  - National Defense Authorization Act passed in both chambers
  - Senate version of coronavirus stimulus package under negotiation



## Consensus language in both cases would include

- Federal government grants for fabs in the U.S.
- Public-private consortium with Dept. of Defense
- Interagency Coordination Committee on ICs
- Investment in secure supply chains and advanced packaging
- Establish new R&D efforts in semi manufacturing and packaging
- Workforce training programs



Thank you.

I welcome your questions.

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