U.S. Department of Commerce
Bureau of Industry and Security
OFFICE OF TECHNOLOGY EVALUATION

CHINA, PCAST, AND THE BIS 2017 ASSESSMENT OF THE U.S. IC DESIGN & MANUFACTURING INDUSTRY

NDIA Trusted Microelectronics Workshop
August 16, 2017

Brad Botwin, Director - Industrial Studies
Macroeconomic Trends

U.S. Trade in Goods with China 2002 – 2016
(in millions of dollars)

All Data from U.S. Census Bureau
Macroeconomic Trends

(in millions of dollars)

All Data from U.S. Census Bureau
Macroeconomic Trends

Trade Between U.S. and China for Integrated Circuits and Microassemblies 2002 - 2016
(in millions of dollars)

U.S. Exports to China
Chinese Imports to U.S.

All Data from U.S. International Trade Commission (HTS 8542)
Macroeconomic Trends

(in millions of dollars)

All Data from U.S. International Trade Commission (HTS 8542)
U.S. IC Design and Manufacturing Assessment
Topics Covered by BIS Survey

- Facility Integrated Circuit Design and Manufacturing by Technology Node and Semiconductor Material Type
- Manufacturing Capabilities and Production Rates
- Employment
- Mask Production and Capability
- Performance of Production Steps - Wafer Processing and Die Packaging
- Controllers and Firmware, Bit Cell and Memory Compiler, and IP
- Performance of Production Functions

- National Security Requirements
- Suppliers
- Sales
- Financials
- Acquisitions, Divestitures, Mergers, and Joint Ventures
- Capital Expenditures
- Research and Development
- Export Regulation and Trade Issues
- Trade and Intellectual Property Issues
- Competitiveness and China
- Cybersecurity
U.S. IC Design and Manufacturing Assessment


- Increase Scholarships for IC-Related Degrees
- Lower Corporate Tax Rates
- Institute an Investment Tax Credit for New IC Facilities
- Increase Funding for Advanced IC-Related Technologies
- Establish a Department of Commerce TAC for ICs
- Require CFIUS Reviews of all IC-related acquisitions
- Enforce World Trade Organization Subsidies Agreement

Number of Companies

Source: U.S. Department of Commerce, Bureau of Industry and Security
U.S. Integrated Circuit Assessment – 2017 – UNCLASSIFIED - Preliminary

Respondents: 133 Companies
U.S. IC Design and Manufacturing Assessment


- Lower Corporate Tax Rates
- Increase Scholarships for IC-Related Degrees
- Increase Funding for Advanced IC-Related R&D
- Enforce World Trade Organization Subsidies Agreement
- Establish a Department of Commerce TAC for ICs

Essential    Not Essential

Number of Companies

Source: U.S. Department of Commerce, Bureau of Industry and Security
U.S. Integrated Circuit Assessment – 2017 – UNCLASSIFIED - Preliminary

Respondents: 133 Companies
U.S. IC Design and Manufacturing Assessment

PCAST Recommendations – “Ranking of Potential U.S. Government Policy Actions” (1 being most important)

- Lower Corporate Tax Rates
- Require CFIUS Reviews of all IC-Related Acquisitions
- Establish a Department of Commerce TAC for ICs
- Form/fund pre-competitive IC-related research consortia

Number of Companies

- Number 1
- Numbers 2 Through 5

Respondents: 133 Companies

Source: U.S. Department of Commerce, Bureau of Industry and Security
U.S. Integrated Circuit Assessment – 2017 – UNCLASSIFIED - Preliminary
U.S. IC Design and Manufacturing Assessment

Capabilities of Fabrication Companies by Technology Node

Source: U.S. Department of Commerce, Bureau of Industry and Security
U.S. Integrated Circuit Assessment – 2017 – UNCLASSIFIED - Preliminary

Respondents: 133 Companies
U.S. IC Design and Manufacturing Assessment
Capabilities of Trusted Fabrication Companies by Technology Node

Source: U.S. Department of Commerce, Bureau of Industry and Security
U.S. Integrated Circuit Assessment – 2017 – UNCLASSIFIED - Preliminary

Respondents: 133 Companies
U.S. IC Design and Manufacturing Assessment

Will the closure of specific Integrated Circuit product lines manufactured in the U.S. due to subsidized Chinese IC competition impact your organization?

Source: U.S. Department of Commerce, Bureau of Industry and Security
U.S. Integrated Circuit Assessment – 2017 – UNCLASSIFIED - Preliminary
U.S. IC Design and Manufacturing Assessment

Will the closure of one or more Integrated Circuit manufacturing facilities in the U.S. due to subsidized Chinese IC competition impact your organization?

Source: U.S. Department of Commerce, Bureau of Industry and Security
U.S. Integrated Circuit Assessment – 2017 – UNCLASSIFIED - Preliminary
U.S. IC Design and Manufacturing Assessment

Will your organization be impacted by Chinese acquisition of your suppliers of materials, equipment, software, and other items critical to your organization's supply chain?

- **57** Yes -- Negative Impact
- **29** Yes -- Neutral Impact
- **2** Yes -- Positive Impact

Designers: 44
Manufacturers: 21
Trusted: 20

Source: U.S. Department of Commerce, Bureau of Industry and Security
U.S. Integrated Circuit Assessment – 2017 – UNCLASSIFIED - Preliminary
Will your organization be impacted by Chinese acquisition of IC intellectual property (IP blocks) normally available under license?

- **Yes -- Negative Impact**: 54
- **Yes -- Neutral Impact**: 18
- **Yes -- Positive Impact**: 2

**Designers**: 42
**Manufacturers**: 16
**Trusted**: 17

Source: U.S. Department of Commerce, Bureau of Industry and Security

*U.S. Integrated Circuit Assessment – 2017 – UNCLASSIFIED - Preliminary*
U.S. IC Design and Manufacturing Assessment
Advanced Integrated Circuit Technologies

Degree of Technological Advantage in the Next 10 – 15 years for the Global IC Industry

Note: This list of technologies refers to Integrated Circuit-specific advances as well as technological shifts enabled by these advances.

Source: U.S. Department of Commerce, Bureau of Industry and Security
U.S. Integrated Circuit Assessment – 2017 – UNCLASSIFIED - Preliminary
Sample Size: 133 Companies
U.S. IC Design and Manufacturing Assessment
Advanced Integrated Circuit Technologies

Number of U.S. Companies Surveyed Currently Performing R&D on Advanced Integrated Circuit Technologies

- Analog Technologies
- Next-Generation High Power IC Devices
- Extreme Integration
- Artificial Intelligence/Deep Learning Architectures
- Hybrid Silicon/Compound Semiconductor Devices (heterogeneous integration)
- Photonic Integrated Circuits/Photonic Computing
- Logic in Memory Structures
- Wide Bandgap Semiconductors (beyond GaN and SiC) for RF Technologies
- Phase Change Electronics
- Subthreshold Electronics
- Quantum Computing
- Neuromorphic Computing
- Ferroelectric Device Technologies
- Carbon Electronics (includes carbon nanotube FETs, graphene interconnects, etc.)
- Spintronics (including spin-torque devices, etc.)
- Tunneling Field Effect Transistors
- Straintronics

Note: This list of technologies refers to Integrated Circuit-specific advances as well as technological shifts enabled by these advances

Source: U.S. Department of Commerce, Bureau of Industry and Security
U.S. Integrated Circuit Assessment – 2017 – UNCLASSIFIED - Preliminary

Sample Size: 133 Companies
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