WSC
World Semiconductor Council

Addressing Counterfeit Semiconductor Products

World Semiconductor Council Anticounterfeiting Task Force

Overview

Because they are used in critically-important applications, counterfeit semiconductors threaten the health, safety, and security of everyone worldwide.

The WSC seeks to partner with electronics companies, government agencies and other organizations worldwide to continuously prevent counterfeit semiconductors from endangering lives.

Background

Semiconductors are the "brains" inside electronics

- Computers, mobile phones, medical equipment, cars, trains, planes, electric power grids, communications systems, etc.

Legitimate semiconductors:

- Manufactured by Original Component Manufacturers
- Highly controlled design, manufacturing, and supply chain
- Sold by OCMs and their authorized distributors/resellers
- Highly reliable and rarely fail

Counterfeit semiconductors:

- Usually used or defective but refurbished to look new
- Poorly-controlled "manufacturing" and supply chain
- Sold on open market (brokers, independent distributors, etc.)
- Unreliable and prone to failure

What Are Semiconductors?

Materials that partially conduct electricity

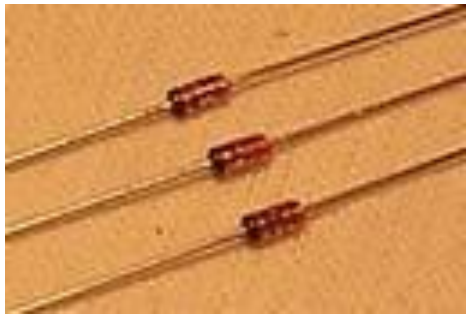
- Typically silicon or gallium arsenide or gallium nitride
- Conductivity adjusted by adding other elements
- Areas of different conductivities used as switches

Three types of semiconductors:

1. **Discrete Semiconductors**
   - Diodes (2 pins) and transistors (3 pins)
   - Typically <$0.20 per unit
2. **Integrated Circuits (ICs):**
   - Up to several billion transistors on one "chip"
   - <$0.20 to >$2000 per unit
3. **System-Level Products:**
   - Typically multiple ICs on a solid or flexible Printed Circuit Board (PCB)
   - <$2 to >$20,000 per unit

Examples of Semiconductor Products

Discrete Semiconductors



Diodes

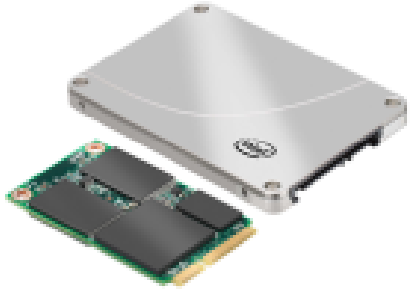
Transistor

Integrated Circuits

Microchips

Processors

System-Level Products



Solid State Drives, Memory, Wi-Fi

Printed Circuit Boards

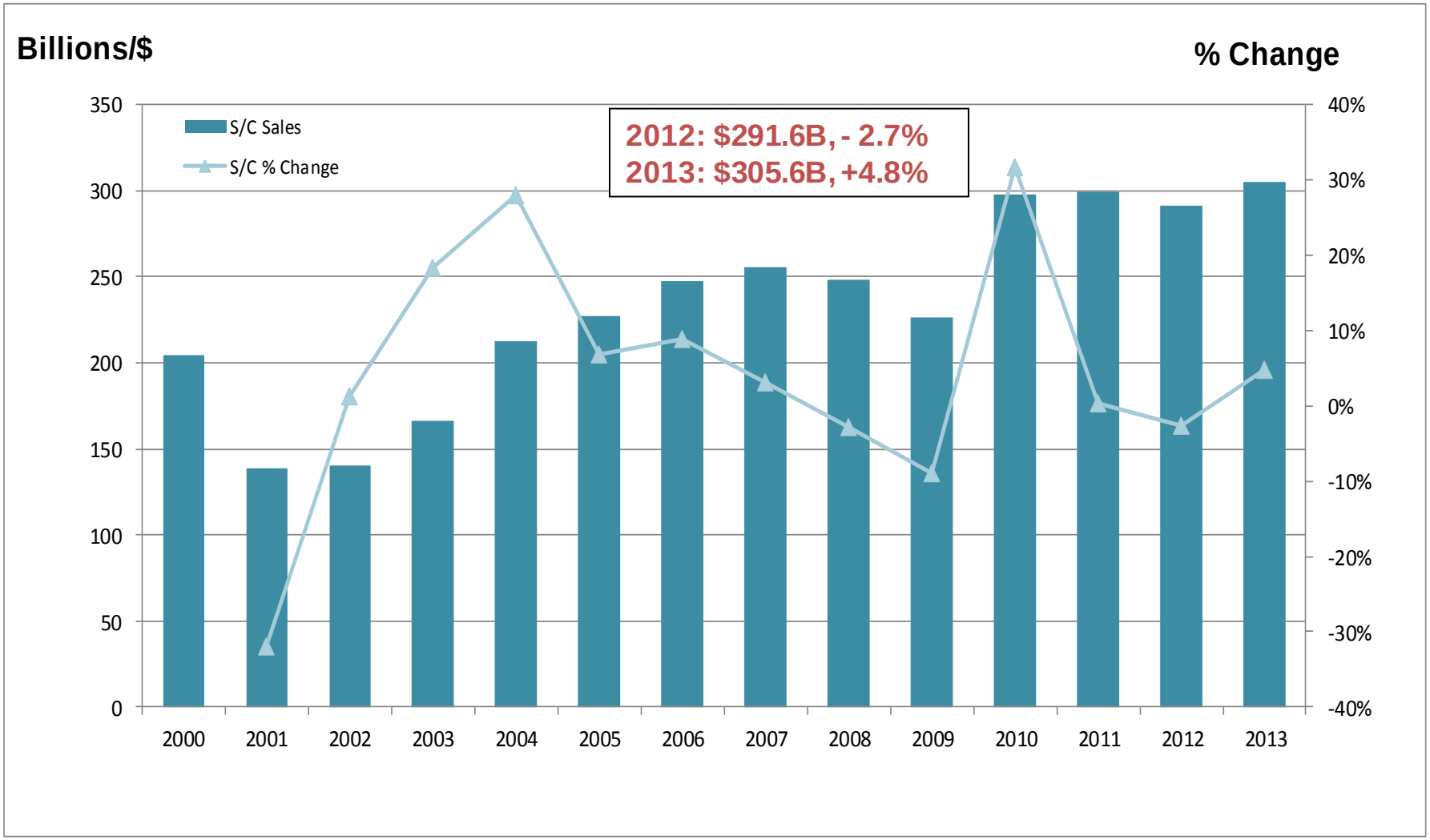
Who We Are

The WSC consists of all semiconductor producing regions:

China
Chinese Taipei
Europe
Japan
Korea
U.S.

- The WSC is uniquely focused on international trade issues of concern for the global semiconductor industry
- The WSC is comprised of industry associations which make recommendations each year to a joint meeting with governments of the six regions

Global Semiconductor Industry Revenues



Source: WSTS

Semiconductor Demand Drivers: 2013 Growth

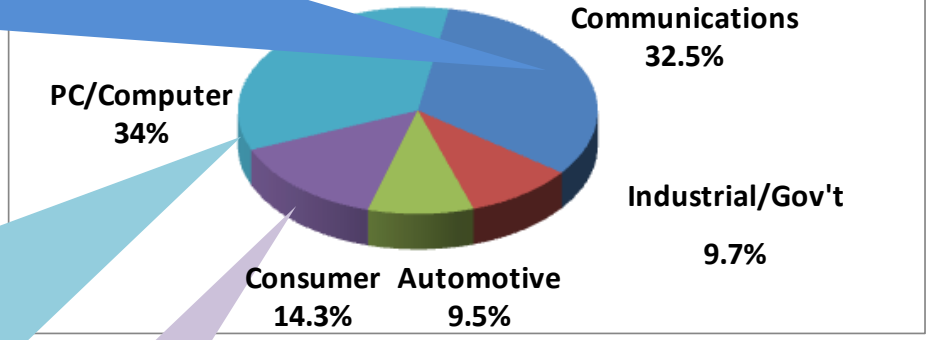
Smartphones and Tablets Drive Convergence

Smartphones surging

Smartphone shipments overtook PC shipments in 2011

PC/Computer usage shifting

Consumers shifting away from traditional concept storage devices to tablets



2013 Total Global Semiconductor Market $306 Billion

TVs

LCD large screen TV sales continue to grow in 2013

Sources: WSTS/ Gartner/Canalys/IDC/DisplaySearch
Note: Military is <1% and is included in Industrial.

Semiconductors: Driving Innovation, Shaping The Future

EDUCATION

- Classroom computers
- Online learning
- Accessing information

ECONOMIC GROWTH

- Creating jobs
- Improving productivity
- Enabling innovation

ENERGY SOLUTIONS

- Enabling alternate energy sources
- Reducing transmission losses
- Energy-efficient homes and vehicles
- Fuel-efficient transportation

HEALTH CARE

- Technology drives advances in medical science
- New tools improve health care:
  - Diagnostic tools
  - Robotic surgery
  - Tools for minimally-invasive surgery
- IT lowers cost of delivery of health care

NAT'L & HOMELAND SECURITY

- Securing critical infrastructure
- Satellite imaging
- Field communications

Semiconductor Application Examples

Home

Aviation

Medical

Critical Infrastructure

Automotive

Definition of Semiconductor Counterfeiting

Semiconductor counterfeiting is considered the act of fraudulently manufacturing, altering, distributing, or offering a product or package that is represented as genuine.

How Legitimate ICs Are Manufactured

45nm Wafer Fab

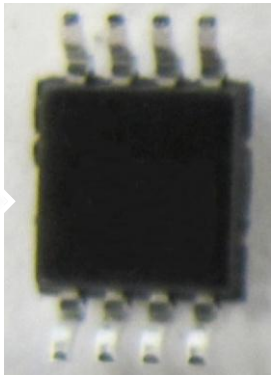
Step 1: IC wafers fabricated in ultra-clean facilities with operators wearing "bunny suits"

How Legitimate ICs Are Manufactured

Step 2: Wafers assembled in packages.

Wafers

Package plating line



Packaged IC

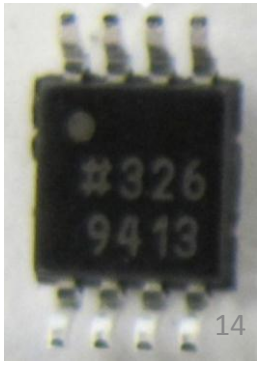
How Legitimate ICs Are Manufactured

Step 3: Packages electrically tested.

Step 4: Packages marked.

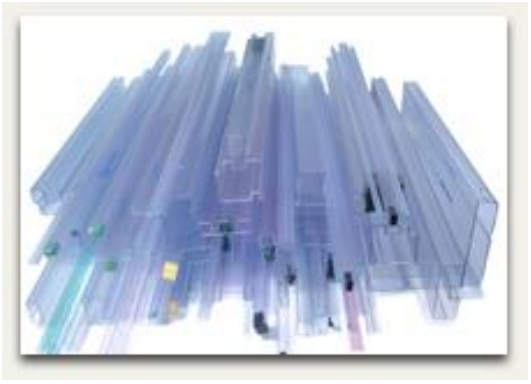
Final Test and Marking line

Final IC



Packaging/Boxing for Legitimate Semiconductors

Wafer Cassette



IC Tubes

IC Trays

Tape & Reel

Packing Materials

Retail Packaging

How Counterfeit ICs Are Typically Made

<u>Step 1:</u> Electronics waste is dis-assembled to expose Printed Circuit Boards (PCBs).

Counterfeit ICs are made under the complete opposite conditions as legitimate ICs. They cannot be expected to operate reliably!

How Counterfeit ICs Are Typically Made

Step 2: Old ICs removed by heating PCBs over open flame to melt solder.

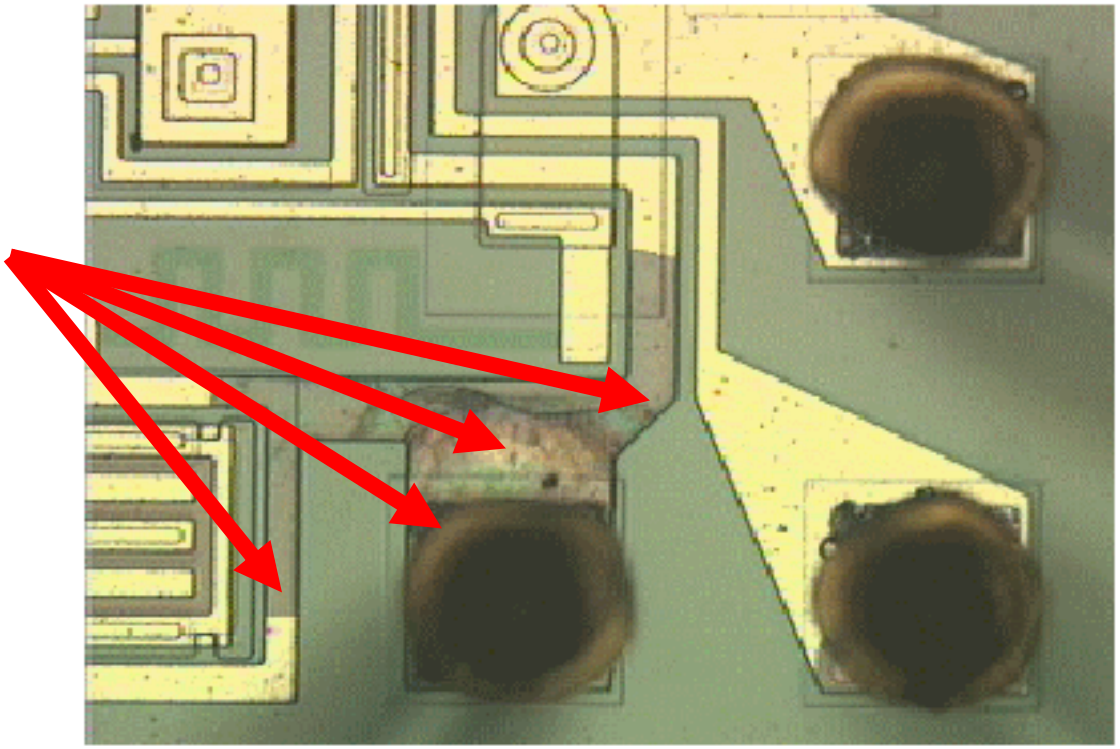
Counterfeit ICs are made under the complete opposite conditions as legitimate ICs. They cannot be expected to operate reliably!

How Counterfeit ICs Are Typically Made

<u>Step 3:</u> Original package markings/production codes removed and new markings added.

Counterfeit ICs are made under the complete opposite conditions as legitimate ICs. They cannot be expected to operate reliably!

Counterfeit Semiconductors Are Unreliable



1. Used ICs were removed from PCBs and re-marked by counterfeiters.
2. The pins were cleaned with acid.
3. After months of use, the acid migrated into the plastic packages and corroded away the metal on the chip (see arrows), resulting in the ICs completely failing.

Counterfeit Semiconductors Threaten Health

Example reported to semiconductor member company:

- **A manufacturer of Automated External Defibrillator (AED) systems bought ICs from a broker**
- **80% of the ICs failed in the AEDs because they were counterfeit**
- **Failure to detect this issue could have resulted in AEDs providing too much voltage to heart attack victims, threatening their lives**

Automated External Defibrillator or AED

Counterfeit Semiconductors Threaten Health

Example reported by US law enforcement:

- **A broker shipped counterfeit microprocessors intended for use in automated intravenous (IV) drip machines**
- **Law enforcement warned the manufacturer not to use the counterfeit microprocessors**
- **Failure to do so could jeopardize the lives of hospital patients**

Automated intravenous drip machine used in hospitals

Counterfeit Semiconductors Threaten Safety

Example reported to semiconductor member company:

- A manufacturer of sauna controllers bought ICs from a broker
- The sauna caught fire because the ICs were counterfeit
- This could have caused major property damage or even loss of life

Sauna heater controller that caught fire due to counterfeit ICs

Counterfeit Semiconductors Threaten Safety

Example reported to semiconductor member company:

- A manufacturer of power supplies for airport landing lights bought ICs from a broker
- The landing lights failed because the ICs were counterfeit
- This could have caused airline takeoff/landing accidents

Counterfeit ICs that failed in power supplies for airport landing lights

Counterfeit Semiconductors Threaten Safety

Example reported by US law enforcement:

- **A broker shipped counterfeit microcontrollers intended for use in braking systems in high-speed trains**
- **Law enforcement warned the manufacturer not to use the counterfeit microcontrollers**
- **Failure to do so could jeopardize the lives of train passengers**

High-speed train

Counterfeit Semiconductors Threaten Safety

Example reported by US law enforcement:

- **A broker shipped counterfeit voltage regulators intended for use in automotive braking systems and airbag deployment systems**
- **Law enforcement warned the manufacturer not to use the counterfeit voltage regulators**
- **Failure to do so could jeopardize the lives of car drivers/passengers**

Air bag deployment

Regional Contacts

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WSC World Semiconductor Council