

# Addressing Counterfeit Semiconductor Products

World Semiconductor  
Council Anticounterfeiting  
Task Force

# Overview

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**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

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## **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?

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## 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

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The WSC consists of all semiconductor producing regions:

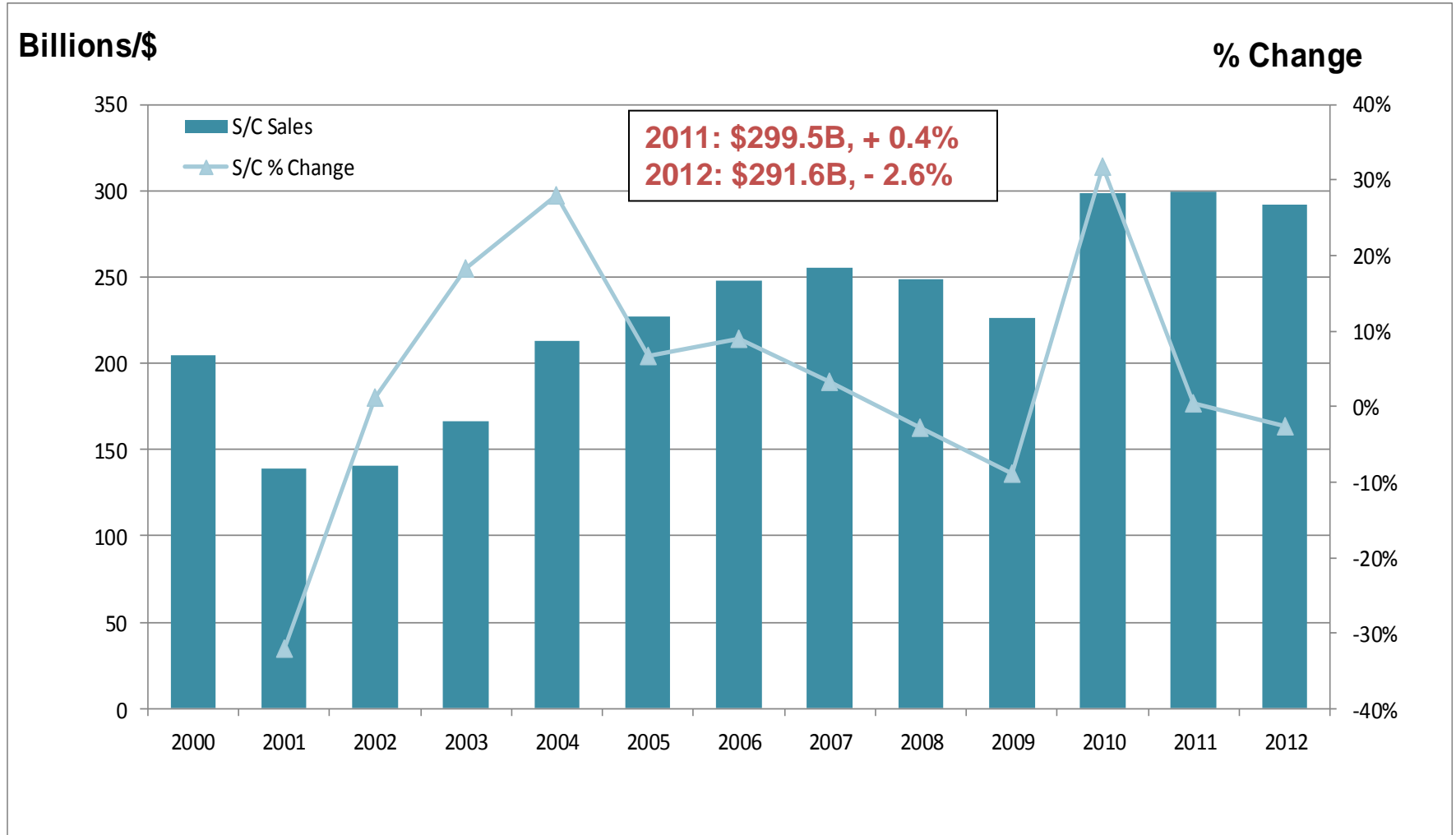
**China**  
**Chinese Taipei**  
**Europe**  
**Japan**  
**Korea**  
**U.S.**



**WSC**  
World Semiconductor Council

- 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: 2012 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*

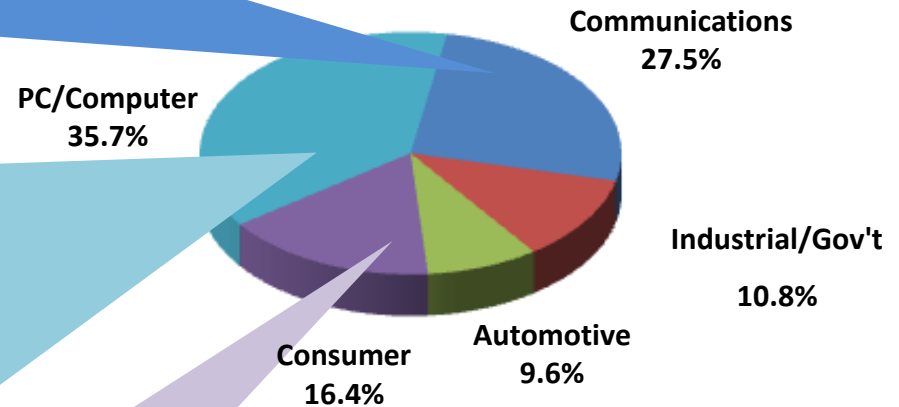


### ***TVs***

*LCD large screen TV sales continue to grow in 2012*



Percent of Semiconductor \$ Demand



***2012 Total Global  
Semiconductor Market  
\$292 Billion***



# Semiconductors: Driving Innovation, Shaping The Future

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## EDUCATION

- Classroom computers
- Online learning
- Accessing information

## ECONOMIC GROWTH

- Creating jobs
- Improving productivity
- Enabling innovation

## ENERGY SOLUTIONS

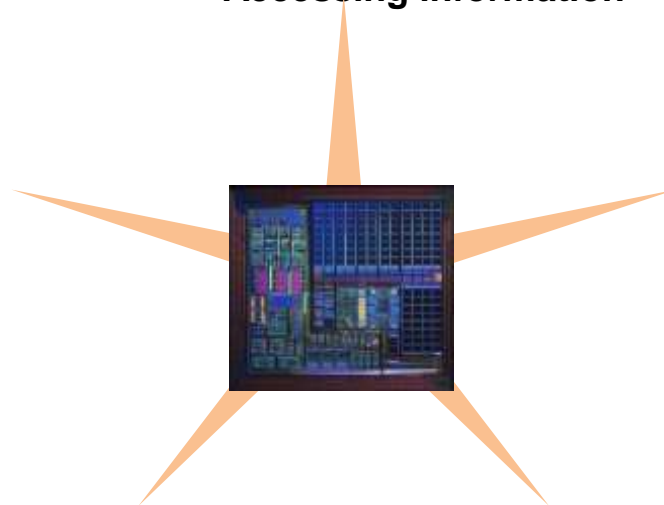
- Enabling alternate energy sources
- Reducing transmission losses
- Energy-efficient homes and vehicles
- Fuel-efficient transportation

## 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

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Home



Aviation



Medical



Critical Infrastructure



Automotive

# Definition of Semiconductor Counterfeiting

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*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

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**45nm Wafer Fab**

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



# How Legitimate ICs Are Manufactured

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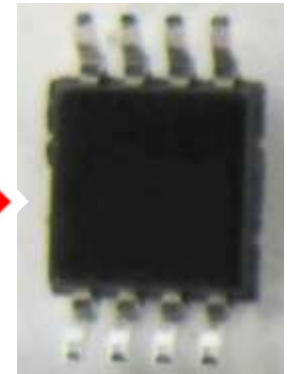
## Step 2: Wafers assembled in packages.



**Wafers**



**Package plating line**



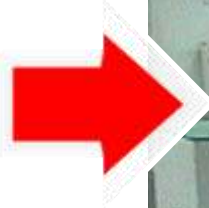
**Packaged IC**



# 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

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**Wafer Cassette**



**IC Tubes**



**IC Trays**



**Tape & Reel**



**Packing Materials**



**Retail Packaging**



# How Counterfeit ICs Are Typically Made

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**Step 1:** 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

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**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

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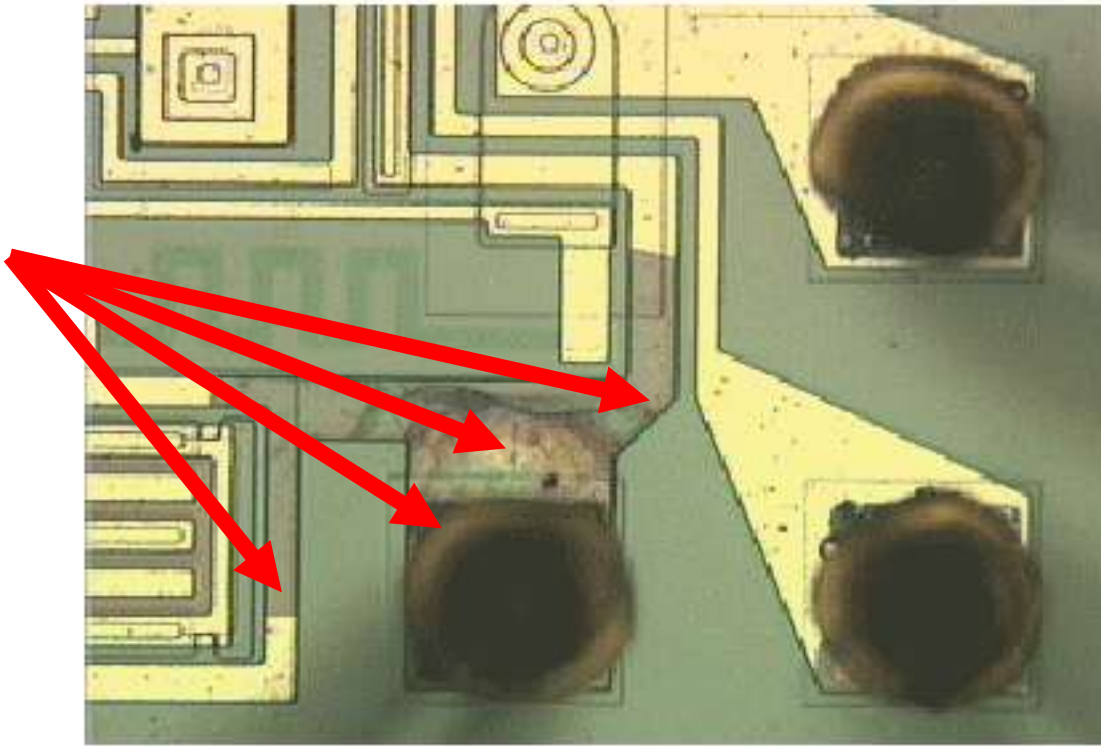
**Step 3:** Original package markings/production codes removed and new markings added.



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

# Counterfeit Semiconductors Are Unreliable

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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

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## 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

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## 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

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## 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

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## 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

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## 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

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## 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

## **SIA in China**

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