WSC
World Semiconductor Council

Addressing Counterfeit Semiconductor Products

World Semiconductor Council Anticounterfeiting Task Force

Counterfeit semiconductors threaten health, safety & security of everyone

Semiconductors are used in a wide variety of critically-important applications- computers, mobile phones, medical equipment, cars, trains, planes, electric power grids, communications systems, and many more.

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

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

What Are Semiconductors?

Materials that partially conduct electricity

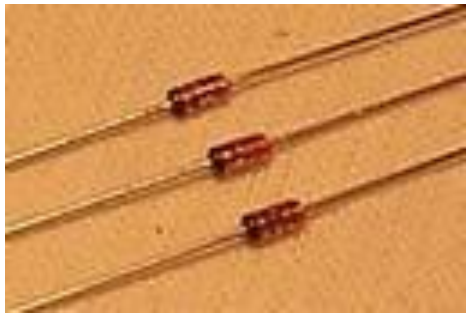
- Typically silicon or gallium arsenide or gallium nitride
- Conductivity adjusted by adding other elements
- Areas of different conductivities used as switches

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

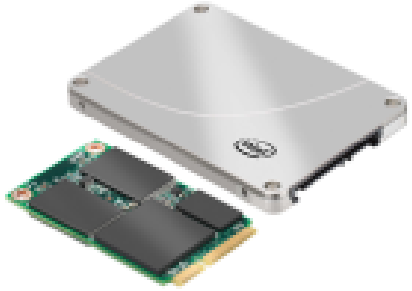
Transistor

Integrated Circuits

Microchips

Processors

System-Level Products



Solid State Drives, Memory, Wi-Fi

Printed Circuit Boards

Semiconductor Application Examples

Home

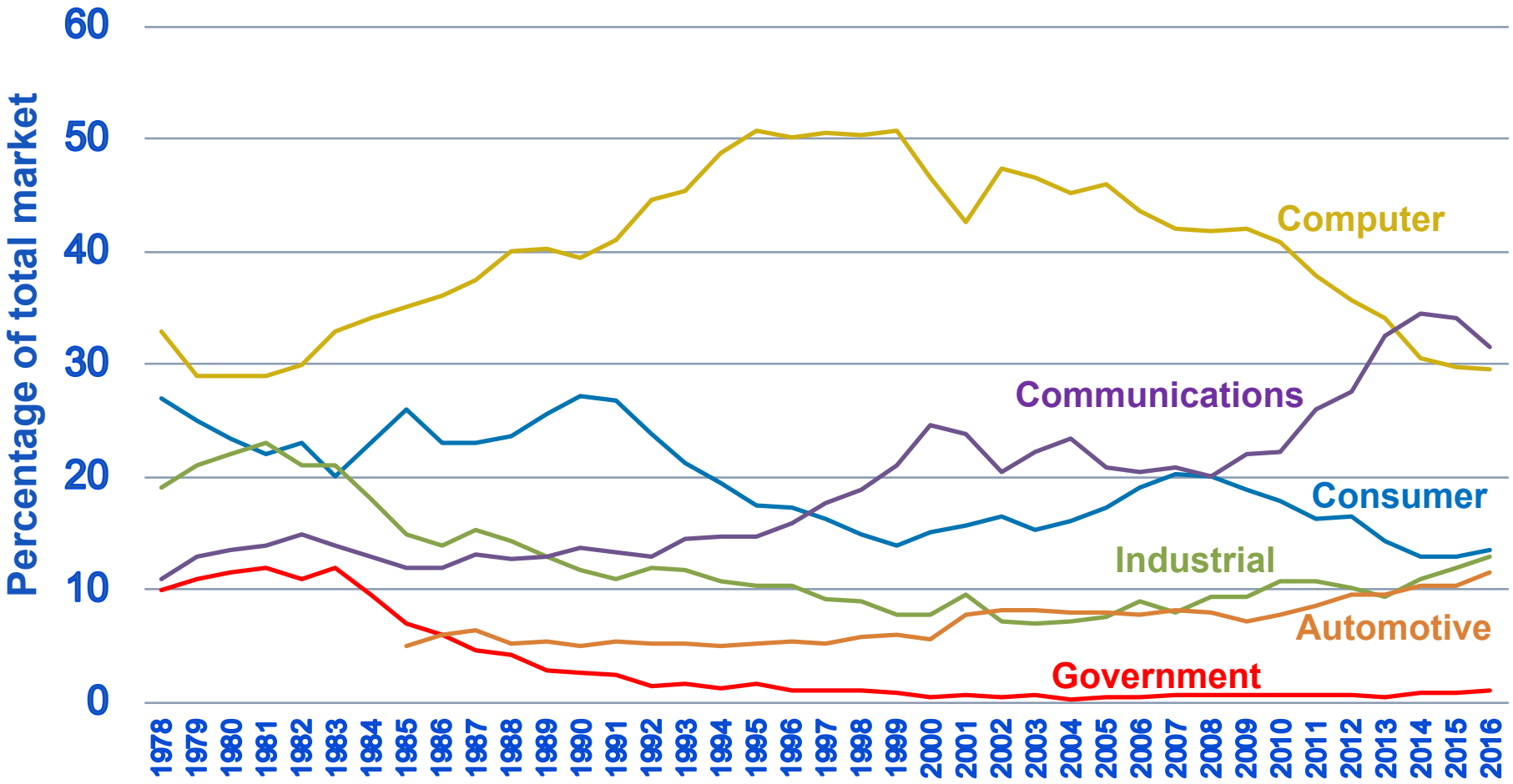
Aviation

Medical

Critical Infrastructure

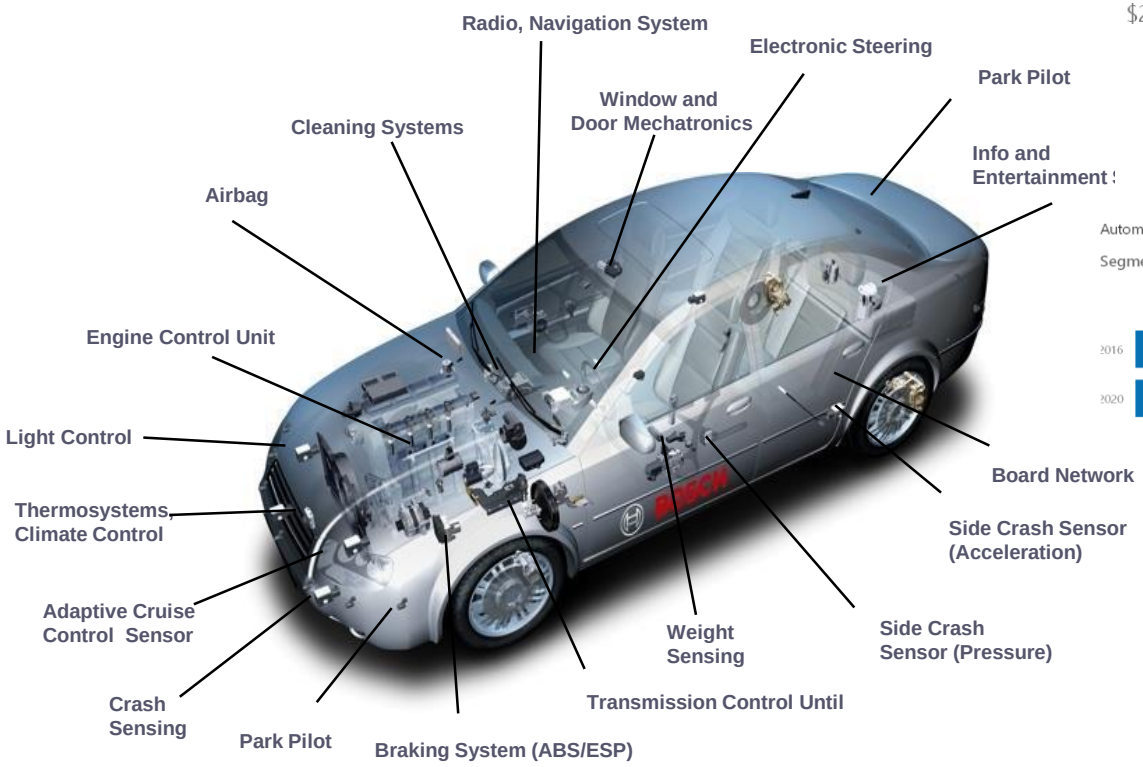
Automotive

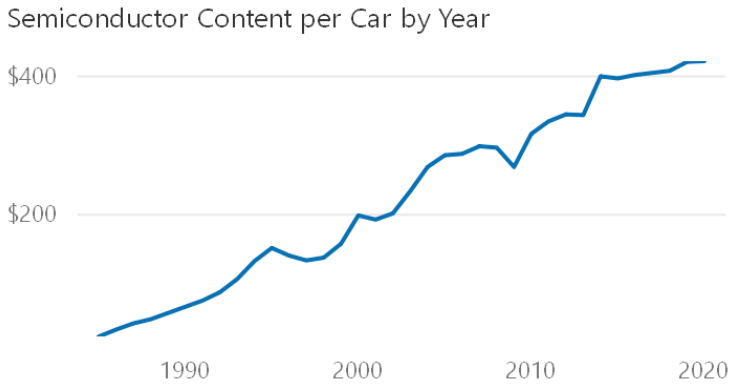
End use markets are changing rapidly

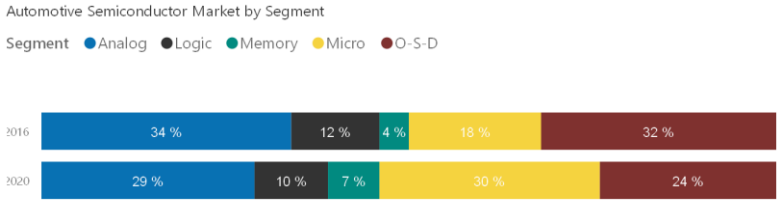


Automobiles are large, growing market for semiconductors

The growth of ADAS (Advanced Driver Assist Systems) and mapping applications, vehicle connectivity, self-driving cars and electric cars drive the growth of automotive semiconductors







Data and information Source: McKinsey, BOSCH, Deutsche Bank, WSTS End Use Report.

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.

Counterfeit semiconductors are unreliable and prone to failure

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

How Legitimate ICs Are Manufactured

45nm Wafer Fab

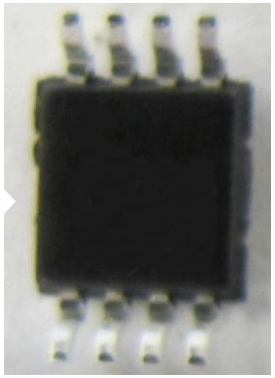
Step 1: IC wafers fabricated in ultra-clean facilities with operators wearing "bunny suits"

How Legitimate ICs Are Manufactured

Step 2: Wafers assembled in packages.

Wafers

Package plating line



Packaged IC

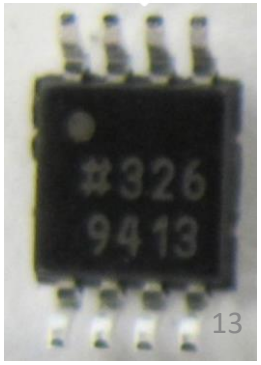
How Legitimate ICs Are Manufactured

Step 3: Packages electrically tested.

Step 4: Packages marked.

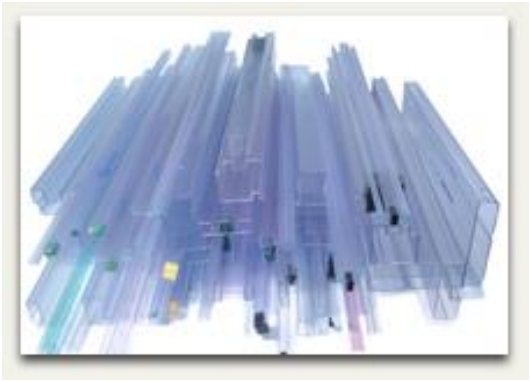
Final Test and Marking line

Final IC

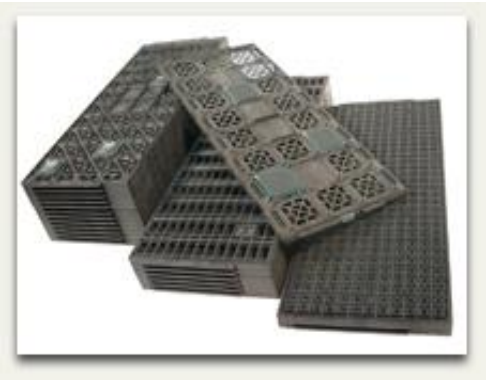


Packaging/Boxing for Legitimate Semiconductors

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

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

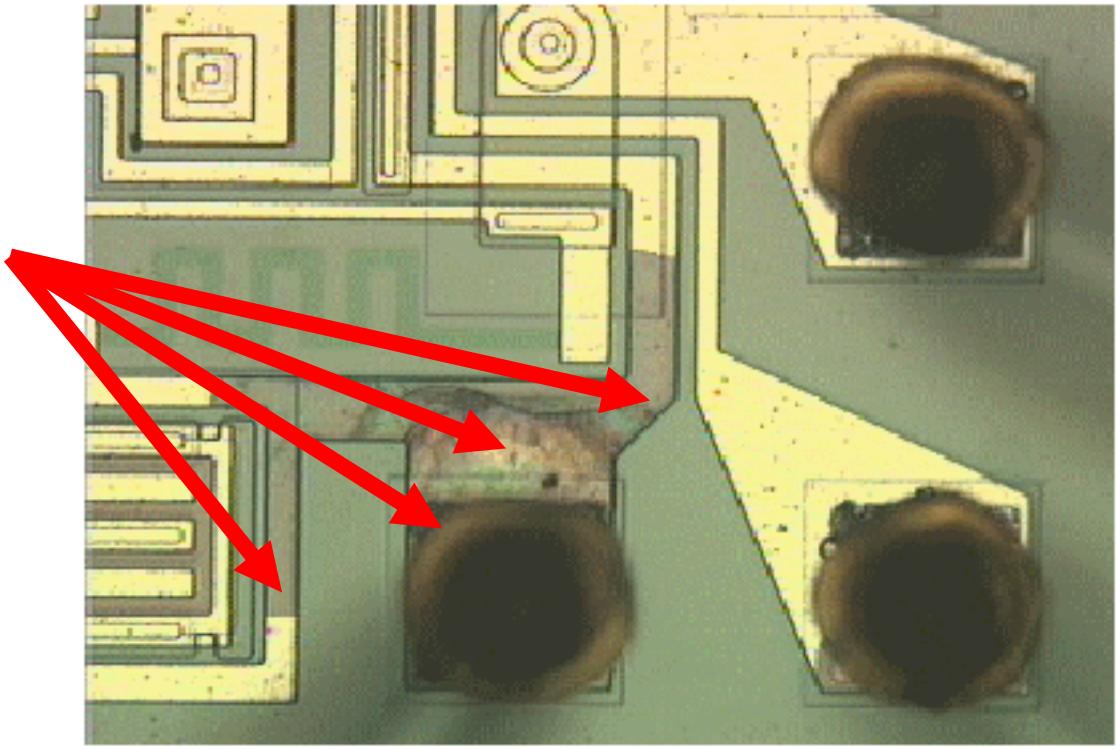
Counterfeit ICs are made under the complete opposite conditions as legitimate ICs. They cannot be expected to operate reliably!

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

Counterfeit Semiconductors Threaten Safety

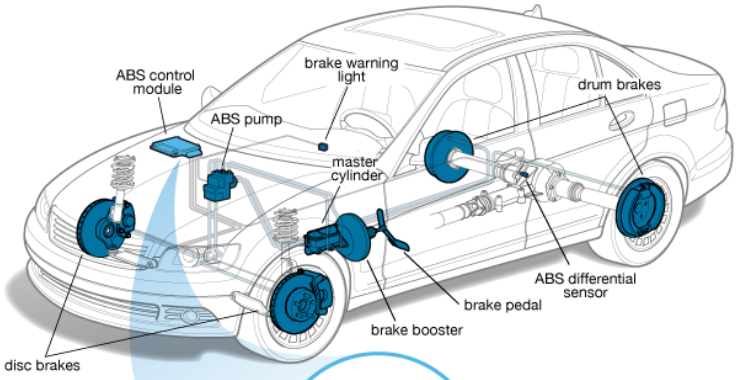
Example Reported to Semiconductor Member Company

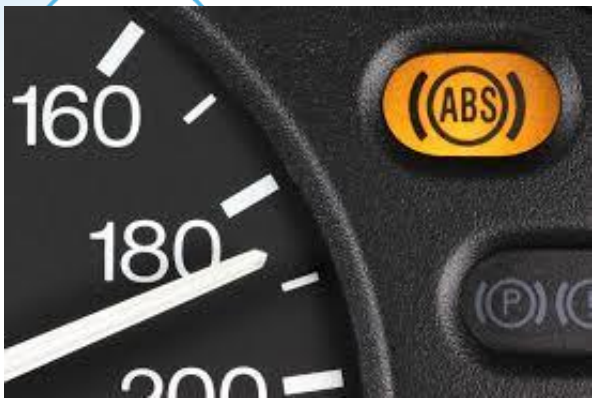
- Customer bought products to be used for on board charging of Electric Vehicle batteries on open market
- >50% of IC failed due to counterfeit
- Failure to detect this issue could have resulted in overloading and destroying batteries and probably jeopardize the lives of car drivers/passengers

Counterfeit Semiconductors Threaten Safety

Example reported by semiconductor member and law enforcement:

- A broker shipped **counterfeit sensors** for use in vehicle dynamics control system and ABS
- Law enforcement stopped the import and informed the OCM
- OCM confirmed that parts are counterfeit; Law Enforcement seized the products
- Failure to do so could jeopardize the lives of car drivers/passengers





Quick visual checks to spot suspect counterfeits

1. Low-quality printing (OCMs use high-quality laser printers)
2. Label print smears
3. Writing on labels
4. No label on inner package

5. Quantity declared does not match quantity on label
6. Faded colors
7. Missing box labels (should be one on each carton box)
8. Inconsistency of part numbers listed on labels with what is shipped
9. Inconsistent label positions
10. Non-Professional Packing

Counterfeit avoidance – best practice

- **Buy authorized** – at OCM directly or at one of OCM's authorized distributors
- **Plan ahead** when receiving Product Change Notification or Discontinuation. Use authorized "after market distributors" if necessary
- **Understand the potential counterfeit risks** for your company and to your end users when sourcing from non-authorized distributors and when using product without 100% traceability!
- **Establish** strict **procurement procedures** that only allow authorized, proven distribution channels – ask for evidence of traceability, liability and warranty!
- Establish **secure procedures for your scrap management** and return material authorizations. Ensure they are followed at all times.
- **Report** suspicious parts / counterfeit parts to OCM and government agencies. Implement a counterfeit electronic control and a counterfeit mitigation policy!
- **Spread anti-counterfeiting awareness** in your Company and at your sub-contractors.
- For Parts bought outside authorized distribution chain: **Implement a fraudulent part detection plan** (Documentation and Packaging Inspection, Visual Inspection of parts, Solvent Test for Remarking, Solvent Test for Resurfacing, Electrical and x-ray tests, etc.)
- Be aware that the analysis results of picture labels or a few pieces can not be automatically applied to the remaining pieces of a shipment which are not tested**. Such analyses are inconclusive and potentially misleading!**

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