



Counterfeit Parts Avoidance Training for EEE Parts

Carlo Abesamis, Procurement Quality Assurance
Jet Propulsion Laboratory, California Institute of Technology



Class Overview

Counterfeit Parts Avoidance Training

- ▶ Introduction
- ▶ Terms and Definitions
- ▶ Awareness Training
 - ▶ The Electronic Parts Counterfeiting Problem
- ▶ Risk Mitigation
 - ▶ Material Procurement
 - ▶ Procurement Risk Mitigation
- ▶ Compliance Verification
- ▶ 1st Hand look at Counterfeit Parts
 - ▶ Hands On Exercise
- ▶ Test
 - ▶ 20 Questions Multiple Choice

- ▶ * SAE Aerospace Standard AS5553: Counterfeit Electronic Components; Avoidance, Detection, Mitigation, and Disposition



Introduction

- ▶ The use of company names is for educational/training purposes only and does not imply any issues between that company and JPL.
- ▶ Footnotes on a number of slides may contain the source of information (i.e. a hyperlink to a website, etc)
- ▶ Interactive class. Discussion and questions are welcome.



Introduction

Counterfeit Parts Avoidance Training

▶ Course Objectives

- ▶ Gain awareness of the counterfeit Electronic, Electrical, & Electro-mechanical (EEE) parts issue
- ▶ Gain basic knowledge of the supply chain environment for EEE parts – concepts discussed are in generalities
- ▶ To mitigate the risks of 1. acquiring counterfeit parts and 2. introducing counterfeit parts into the system
- ▶ To learn the basic suite of inspections/techniques used for compliance verification

▶ Class background

- ▶ Instructor(s)
- ▶ Attendees
 - ▶ Work function, course expectation, experience with counterfeit goods



Terms and Definitions

Counterfeit Parts Avoidance Training

- ▶ **AFTERMARKET MANUFACTURER:** A manufacturer that meets one or more of the following four criteria:
 - ▶ 1. The manufacturer is authorized by the OCM to produce and sell replacement parts, usually due to an OCM decision to discontinue production of a part. Parts supplied are produced from materials that have been
 - a. transferred from the OCM to the Aftermarket Manufacturer, or
 - b. produced by the Aftermarket Manufacturer using OCM tooling and intellectual property (IP).
 - ▶ 2. The manufacturer produces parts using semiconductor dice or wafers, manufactured by and traceable to an OCM, that have been properly stored until use and are subsequently assembled, tested, and qualified using processes that meet technical specifications without violating the OCM's intellectual property rights (IPR), patents, or copyrights.
 - ▶ 3. The manufacturer produces parts through emulation, reverse-engineering, or redesign, that match the OCM's specifications and satisfy customer needs without violating the OCM's IPR, patents, or copyrights.
 - ▶ In any case, the Aftermarket Manufacturer must label or otherwise identify its parts to ensure that the "as shipped" aftermarket manufactured part should not be mistaken for the part made by the OCM.

* AS6081 - Counterfeit Electronic Parts; Avoidance Protocol, Distributors



Terms and Definitions

Counterfeit Parts Avoidance Training

- ▶ **APPROVED SUPPLIER:** Suppliers that are formally assessed, determined to provide acceptable risk of providing counterfeit parts, and entered on register of approved suppliers. Formal assessment can be performed by the procuring Organization or by a third party.
- ▶ **AUTHORITY HAVING JURISDICTION:** A statutory authority can differ between countries, the term is used to refer to the governmental organization at the federal, national, state, or local entity having statutory authority to respond to, enforce, or prosecute anti-counterfeiting laws. Examples are Customs and Judicial bodies.
- ▶ **AUTHORIZED DISTRIBUTION:** Transactions conducted by an OCM-Authorized Distributor distributing product within the terms of an OCM contractual agreement. Contractual Agreement terms include, but are not limited to, distribution region, distribution products or lines, and warranty flow down from the OCM. Under this distribution the distributor would be known as an Authorized Distributor. For the purposes in this Standard, Franchised Distribution is considered synonymous with Authorized Distribution.
- ▶ **AUTHORIZED (FRANCHISED) DISTRIBUTOR:** Distributor when they perform Authorized Distribution.
- ▶ **AUTHORIZED SUPPLIER:** Aftermarket Manufacturers as defined above and OCM authorized sources of supply for a part (i.e., Franchised Distributors, Authorized Distributors).

*AS6081 - Counterfeit Electronic Parts; Avoidance Protocol, Distributors

June 2011



Terms and Definitions

Counterfeit Parts Avoidance Training

- ▶ **BROKER:** In the independent distribution market, Brokers are professionally referred to as Independent Distributors. See definitions for “Broker Distributor” and “Independent Distributor”.
- ▶ **BROKER DISTRIBUTOR:** A type of Independent Distributor that works in a “Just in Time” (JIT) environment. Customers contact the Broker Distributor with requirements identifying the part number, quantity, target price, and date required. The Broker Distributor searches the industry and locates parts that meet the target price and other Customer requirements.
- ▶ **CERTIFICATE OF CONFORMANCE (C of C, CoC):** A document provided by a Supplier formally declaring that all buyer purchase order requirements have been met. The document may include information such as manufacturer, distributor, quantity, lot and/or date code, inspection date, etc., and is signed by a responsible party for the Supplier.
- ▶ **CERTIFICATE OF CONFORMANCE AND SUPPLY CHAIN TRACEABILITY (CoCT):** A Certificate of Conformance required by certain military specifications which requires documented supply chain traceability from the Qualified Parts List/Qualified Manufacturers List (QPL/QML) manufacturer through delivery to a government agency if the material is not procured directly from the approved manufacturer.

*AS6081 - Counterfeit Electronic Parts; Avoidance Protocol, Distributors

June 2011



Terms and Definitions

Counterfeit Parts Avoidance Training

- ▶ **DESTRUCTIVE PHYSICAL ANALYSIS (DPA):** A systematic, logical, detailed examination of parts during various stages of physical disassembly, conducted on a sample of completed parts from a given lot, wherein parts are examined for a wide variety of design, workmanship, and/or processing problems. Information derived from DPA may be used to:
 - a. preclude installation of inauthentic parts or parts having patent or latent defects
 - b. aid in disposition of parts that exhibit anomalies
 - c. aid in defining improvements or changes in design, materials, or processes
 - d. evaluate Supplier production trends
- ▶ **DISPOSITION:** Decisions made by authorized representatives within an Organization concerning future treatment of nonconforming material. Examples of dispositions are to scrap, use-as-is (normally accompanied by an approved variance/waiver), retest, rework, repair, or return-to-supplier.
- ▶ **FRANCHISED DISTRIBUTION:** For the purposes in this Standard, Franchised Distribution is considered synonymous with Authorized Distribution (see “Authorized Distribution” definition above).



Terms and Definitions

- ▶ **HOMOGENEOUS LOT:** A group of parts that:
 - a. Are received in a single shipment
 - b. Are marked or otherwise identified with identical lot, batch, run, and identification information (e.g., dates codes, lot codes, serial numbers),
 - c. Are identical in appearance to the unaided eye (parts and packaging),
 - d. Appear to have been subjected to the same handling, packaging, and/or storage conditions, and
 - e. Have maintained their physical placement relative to each other (i.e., have never been separated based on evidence such as source, packaging, labeling).
- ▶ **INDEPENDENT DISTRIBUTOR:** A distributor that purchases parts with the intention to sell and redistribute them back into the market. Purchased parts may be obtained from Original Equipment Manufacturers (OEMs) or Contract Manufacturers (typically from excess inventories), or from other Distributors (Franchised, Authorized, or Independent). Resale of the purchased parts (redistribution) may be to OEMs, Contract Manufacturers, or other Distributors. Independent Distributors do not normally have contractual agreements or obligations with OCMs. See definition of “Authorized (Franchised) Distributor.”

*AS6081 - Counterfeit Electronic Parts; Avoidance Protocol, Distributors



Terms and Definitions

Counterfeit Parts Avoidance Training

- ▶ **OPEN MARKET:** The trading market that buys or consigns primarily OEM and Contract Manufacturer's excess inventories of new electronic parts and subsequently utilizes these inventories to fulfill supply needs of other OEMs and contract manufacturers, often due to urgent or obsolete part demands.
- ▶ **ORGANIZATION:** In the context of this document, it refers to distributors that supply electronic parts from any source other than directly from OCMs or Authorized (Franchised) Distributors. This includes, but is not limited to, Independent Distributors, Brokers, Service Providers, 3PL Providers, and Authorized (Franchised) Distributors when sourcing parts from outside the OCM's authorized channel.
- ▶ **ORIGINAL COMPONENT MANUFACTURER (OCM):** A company that manufactures a part that it has designed and for which it owns the IPR.

Notes:

1. The part and/or its packaging are typically identified with the OCM's trademark.
2. OCMs may contract out manufacturing and/or distribution of their product.
3. Different OCMs may supply product for the same application or to a common specification.



Terms and Definitions

Counterfeit Parts Avoidance Training

- ▶ **ORIGINAL EQUIPMENT MANUFACTURER (OEM):** A company that manufactures products that it has designed from purchased components and sells those products under the company's brand name.
- ▶ **PACKAGING (COMPONENT):** Component packaging refers to the manner in which electronic parts are packaged in preparation for use by electronic assemblers. The determination of packaging types is determined by product sensitivities such as moisture, physical (lead pitch, co-planarity), electrostatic discharge (ESD), as well as the method (manually, or by use of automated equipment) to be used to place parts on the printed circuit board. There are four main types of packaging: bulk, trays, tubes, and tape and reel.
- ▶ **PART(S):** One or more pieces joined together, which are not normally subject to disassembly without destruction or impairment of intended design use.
- ▶ **REFINISHED:** Using post-manufacture plating methods (such as solder dipping) to alter the plating composition on a part's leads.
- ▶ **REFURBISHED:** Parts that have been brightened, polished or renovated in an effort to restore them to a "like new" condition. Refurbished parts may have had their leads realigned and re-tinned and subjected to cleaning agents and processes.

*AS6081 - Counterfeit Electronic Parts; Avoidance Protocol, Distributors

June 2011



Terms and Definitions

Counterfeit Parts Avoidance Training

- ▶ **STOCKING DISTRIBUTOR:** A type of Independent Distributor that stocks large inventories typically purchased from OEMs and Contract Manufacturers. The handling, chain of custody, and environmental conditions for parts procured from Stocking Distributors are generally better known than for product bought and supplied by Broker Distributors.
- ▶ **SUPPLIER:** Within the context of this document, a blanket description of all sources of supply for a part (e.g., OCM, OEM, Authorized (Franchised) Distributor, Independent Distributor, Broker Distributor, Stocking Distributor, Aftermarket Manufacturer, Government Supply Depot, 3PL Provider).
- ▶ **SUPPLY CHAIN TRACEABILITY:** Documented evidence of a part's supply chain history (e.g., C of C) back to the OCM. This refers to documentation of all supply chain intermediaries and significant handling transactions from OCM to Organization.
- ▶ **SUPPLY CHANNEL:** The general category of Supplier, such as Open Market, OCM, Aftermarket Manufacturers, Authorized (Franchised) Distributor, 3PL Provider, Independent Distributor, Broker Distributor, OEM Surplus, etc.

[*Click here for Supply Chain illustration*](#)

*AS6081 - Counterfeit Electronic Parts; Avoidance Protocol, Distributors

June 2011



Terms and Definitions

Counterfeit Parts Avoidance Training

- ▶ **THIRD-PARTY LOGISTICS (3PL) PROVIDERS:** Firms which provide outsourced or "third party" logistics services to companies for supply chain management functions. 3PL Providers typically specialize in integrated operation, warehousing and transportation services that can be scaled and customized to customer's needs based on market conditions and the demands and delivery service requirements for their products and materials.
- ▶ **UNUSED (NEW SURPLUS):** Electronic parts that have not been previously used (i.e., attached to a board or powered up since leaving the supply chain). A shipment of unused material can contain mixed date codes, lot codes, or countries of origin, and should be received in unused factory or third party packaging. The material may have minor scratches or other physical defects as a result of handling, but the leads should be in good condition and should not be refurbished. The material should be guaranteed to meet the manufacturer's full specifications. Unused programmable parts should be unprogrammed.
- ▶ **UPRATED:** Assessment which results in the extension of a part's ratings to meet the performance requirements of an application in which the part is used outside the manufacturer's specification range.

*AS6081 - Counterfeit Electronic Parts; Avoidance Protocol, Distributors

June 2011



Terms and Definitions

Counterfeit Parts Avoidance Training

- ▶ **UPSCREENED:** Additional part testing performed to produce parts verified to specifications beyond the part manufacturer's operating parameters. Examples are Particle Impact Noise Detection (PIND) testing, temperature screening, Radiation Hardness Assurance testing, etc.

[*click here for further discussion*](#)

- ▶ **USED (REFURBISHED OR PULLED):** Product that has been electrically charged and subsequently pulled or removed from a socket or other electronic application. Used product may be received in non-standard packaging (i.e., bulk), and may contain mixed lots, date codes, be from different facilities, etc. Parts may have physical defects such as scratches, slightly bent leads, test dots, faded markings, chemical residue or other signs of use, but the leads should be intact. Used product may be sold with a limited warranty, and programmable parts may still contain partial or complete programming which could impact the part's functionality. Used parts marketed as refurbished should be declared as such.
- ▶ **DIE:** A small block of semiconducting material, on which a given functional circuit is fabricated. Typically, integrated circuits are produced in large batches on a single wafer of electronic-grade silicon. The wafer is cut ("diced") into many pieces, each containing one copy of the circuit. Each of these pieces is called a die.

*AS6081 - Counterfeit Electronic Parts; Avoidance Protocol, Distributors, Wikipedia



Terms and Definitions

- ▶ **DECAPSULATION:** is a failure analysis step performed to open a plastic package to facilitate the inspection, chemical analysis, or electrical examination of the die and the internal features of the package. A widely used decapsulation technique is Manual Chemical Etching.
 - ▶ Consists of manually dispensing acid on the surface of a package to remove the plastic material covering the die. Red fuming nitric acid (HNO₃) or sulfuric acid (H₂SO₄) is often used for this purpose. A cavity is first milled on the top surface of the package. Red fuming nitric acid heated to about 85-140 deg C or sulfuric acid heated to 140 deg C is then repeatedly dropped into the cavity to remove the plastic material covering the die. When the die has been exposed adequately, the unit is rinsed with acetone then with D/I water, before being blow-dried carefully.

If the package being opened is hermetic, then the process is referred to as 'delidding' or 'decapping.' The techniques used for decapsulation are very different from those of delidding and decapping.

Delidding/decapping is a purely mechanical process. It may refer to the prying of the combo lid off a ceramic package, or the application of opposite torques to the top and bottom parts of the ceramic DIP to break the seal glass, or the cutting of the weld around a metal can.

* Siliconfareast.com



Terms and Definitions

Counterfeit Parts Avoidance Training

- ▶ **SUSPECT PART:** A part in which there is an indication by visual inspection, testing, or other information that it may have been misrepresented by the supplier or manufacturer and may meet the definition of fraudulent part or counterfeit part provided below.
- ▶ **FRAUDULENT PART:** Any suspect part knowingly misrepresented to the customer as meeting the customer's requirements.

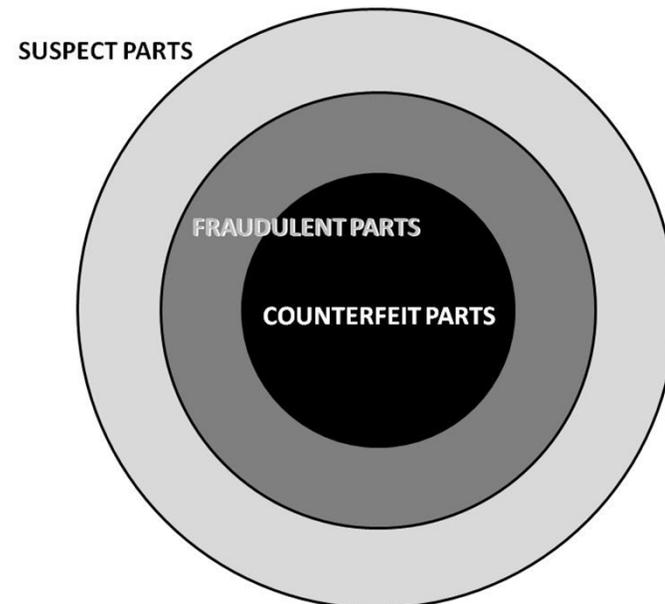


Terms and Definitions

Counterfeit Parts Avoidance Training

- ▶ **COUNTERFEIT PART:** A fraudulent part that has been confirmed to be a copy, imitation or substitute that has been represented, identified, or marked as genuine, and/or altered by a source without legal right to do so with intent to mislead, deceive or defraud.

Note: The following diagram depicts the above relationships between Suspect, Fraudulent and Counterfeit Parts. A Suspect Parts becomes a Fraudulent or Counterfeit Part through further evaluation and testing. All counterfeit parts are fraudulent, but not all fraudulent parts are counterfeit. There are legal distinctions between counterfeit and fraudulent parts. Legal counsel and/or the OCM should be consulted to determine the nature and extent of these distinctions.



Click Here for Exercise [1](#), [2](#)

*AS6081 - Counterfeit Electronic Parts; Avoidance Protocol, Distributors

June 2011



Awareness Training

Counterfeit Parts Avoidance Training

- ▶ Introduction
 - ▶ E-Waste
 - ▶ Environmental issue and Counterfeit
- ▶ Who : Vision Tech Components Story
- ▶ What : BIS Data
- ▶ Where : BIS Data
- ▶ How : MVP Micro Story





Electronic Waste (E-Waste)

Counterfeit Parts Avoidance Training

- ▶ The EPA estimates that 205 million computer products were disposed of in 2007
- ▶ Electronics Recycling is now the fastest growing solid waste stream in the world
- ▶ E-waste stream creates opportunities for counterfeiters
 - ▶ A rich material source of product at the end of service life
 - ▶ Counterfeiters re-mark recycled e-waste with different part numbers, recent date codes, uprated characteristics and return it to the supply chain
 - ▶ Multiple opportunities for the introduction of counterfeit parts into the supply chain

• http://www.foxbusiness.com/personal-finance/2010/09/07/steps-disposing/?cmpid=prn_baynote_fallback_3_steps_to_take_when_disposing_of_your_computer#content



Awareness Training

▶ Link to Videos:

▶ <http://www.pbs.org/frontlineworld/stories/ghana804/>

▶ http://images.businessweek.com/ss/08/10/1002_counte_rfeit_narrated/index.htm





Awareness: E-Waste

Counterfeit Parts Avoidance Training



▶ * <http://www.andrew.cmu.edu/user/saraj/Root/ewaste-route1.gif>

June 2011



Awareness: E-Waste

Counterfeit Parts Avoidance Training



▶ www.googleearth.com



Awareness Training

Counterfeit Parts Avoidance Training

- ▶ Who/Why
 - ▶ Individuals that stand to make a profit
 - ▶ Vision Tech Components Story
- ▶ What is being counterfeited?*
- ▶ Fifty percent of OCMs have encountered counterfeit electronic parts from 2005 to 2008.
- ▶ Respondents indicated that counterfeit products are being discovered in all 14 discrete electronic
 - ▶ component and six microcircuit product categories listed in the survey (see Figures II-2 and II-3).
 - ▶ Counterfeit activity reported by manufacturers of discrete components was highest for electromechanical devices and thyristors, while manufacturers of microcircuits cited microprocessors as the most prevalent counterfeit part.

* DEFENSE INDUSTRIAL BASE ASSESSMENT: COUNTERFEIT ELECTRONICS PREPARED BY US DEPT OF COMMERCE BUREAU OF INDUSTRY AND SECURITY



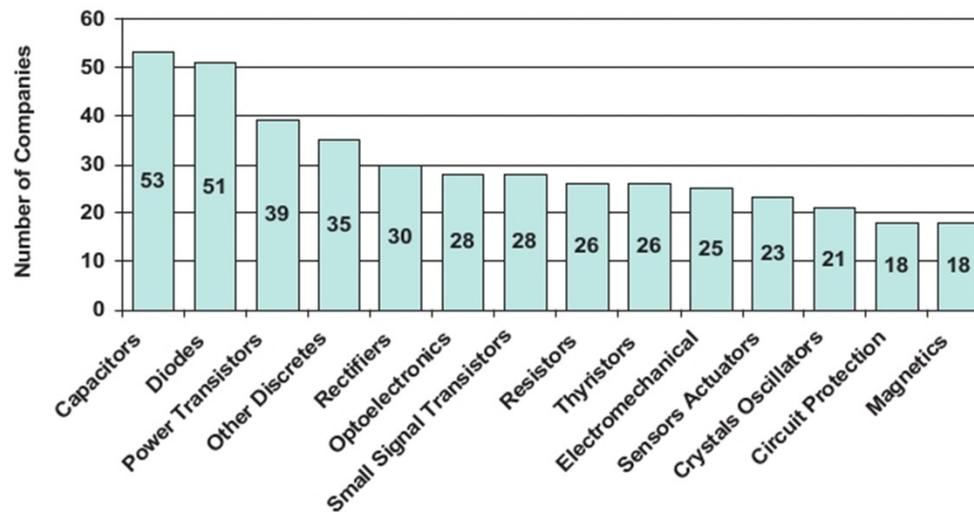
June 2011



Awareness Training

Counterfeit Parts Avoidance Training

Figure VII-3: Types of Parts Suspected/Confirmed to be Counterfeit - Discretes



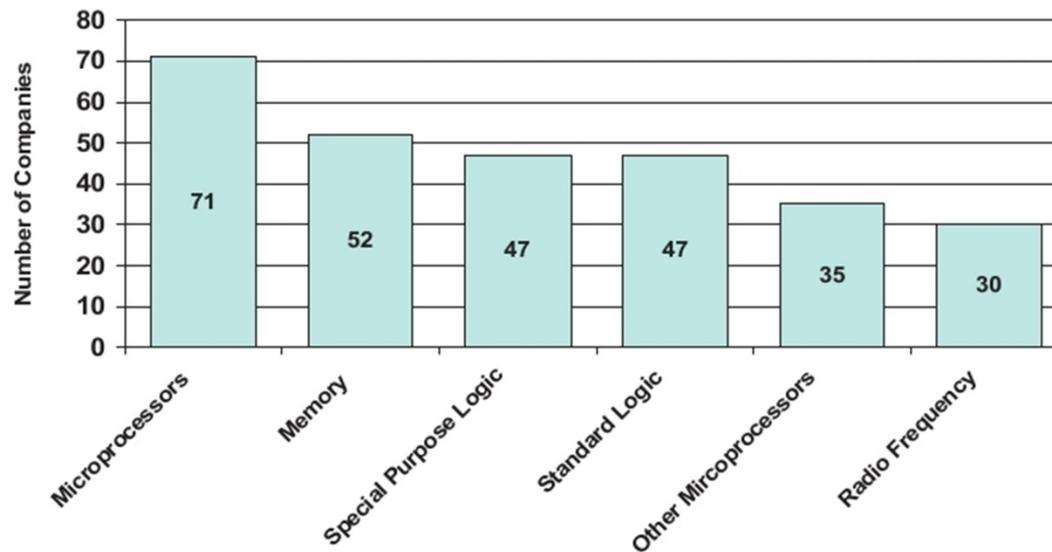
Source: U.S. Department of Commerce, Office of Technology Evaluation, Counterfeit Electronics Survey, November 2009.



Awareness Training

Counterfeit Parts Avoidance Training

Figure VII-4: Types of Parts Suspected/Confirmed to be Counterfeit - Microcircuits



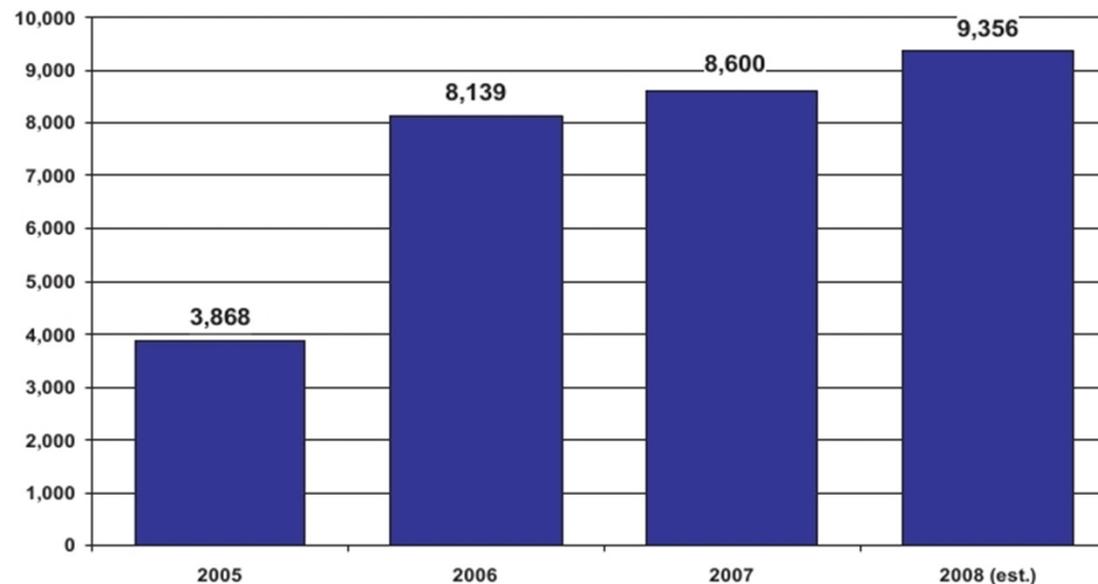
Source: U.S. Department of Commerce, Office of Technology Evaluation,
Counterfeit Electronics Survey, November 2009.



Awareness Training

Counterfeit Parts Avoidance Training

**Figure VII-7: Total Counterfeit Incidents:
OCMs, Distributors, Board Assemblers, Prime/Sub
Contractors 2005 - 2008**



Source: U.S. Department of Commerce, Office of Technology Evaluation,
Counterfeit Electronics Survey, November 2009.

* DEFENSE INDUSTRIAL BASE ASSESSMENT: COUNTERFEIT ELECTRONICS PREPARED BY US DEPT OF COMMERCE BUREAU OF INDUSTRY AND SECURITY

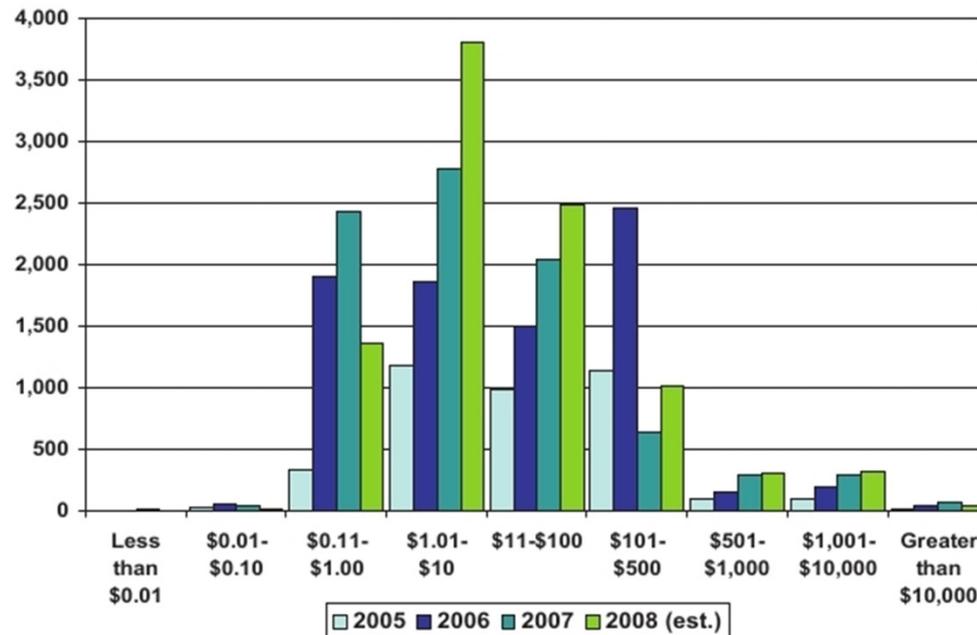
June 2011



Awareness Training

Counterfeit Parts Avoidance Training

Figure VII-9: Counterfeit Incidents by Product Resale Value: (2005 - 2008)



Source: U.S. Department of Commerce, Office of Technology Evaluation, Counterfeit Electronics Survey, November 2009.



Awareness Training

Counterfeit Parts Avoidance Training

**Figure VII-10: Types of Counterfeit Incidents
(2005-2008)**

Type of Product	2005	2006	2007	2008 (est.)
Industrial/Commercial	1739	4860	3841	2839
Consumer	154	345	398	531
High Reliability – Industrial	49	81	164	488
Qualified Manufacturers List (QML)	49	77	161	261
Critical Safety	42	63	93	277
Qualified Products List (QPL)	16	39	111	144
High Reliability – Medical	1	24	58	105
ITAR Controlled	15	10	67	19
Commercial Aviation	9	15	17	27
High Reliability – Automotive	2	6	8	25
Generalized Emulation Microcircuits (GEM)	0	0	0	2

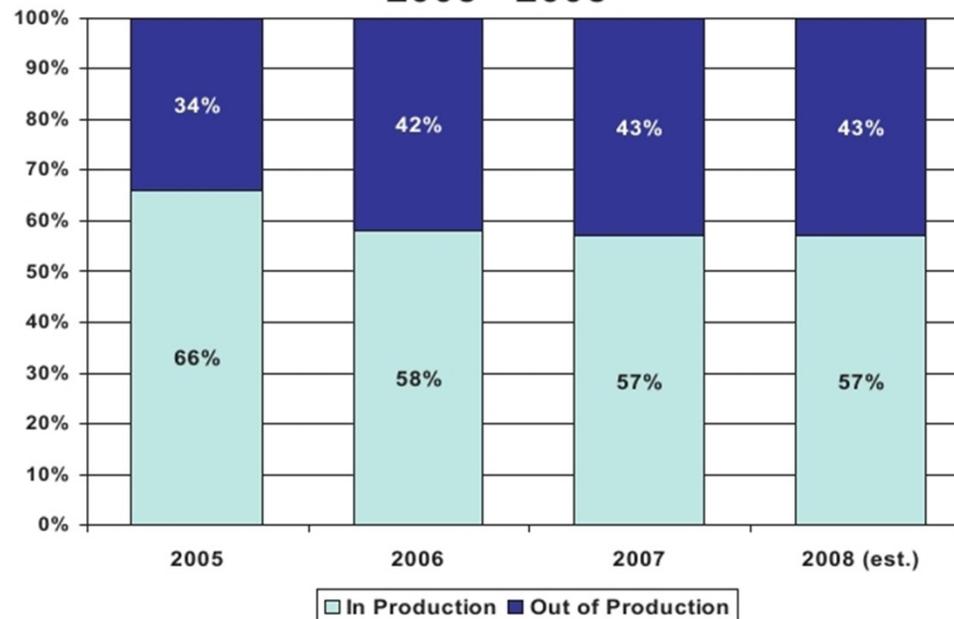
Source: U.S. Department of Commerce, Office of Technology Evaluation, *Counterfeit Electronics Survey*, November 2009.



Awareness Training

Counterfeit Parts Avoidance Training

Figure VII-11: Percent of Counterfeit Incidents Involving In/Out of Production Products 2005 - 2008



Source: U.S. Department of Commerce, Office of Technology Evaluation, Counterfeit Electronics Survey, November 2009.

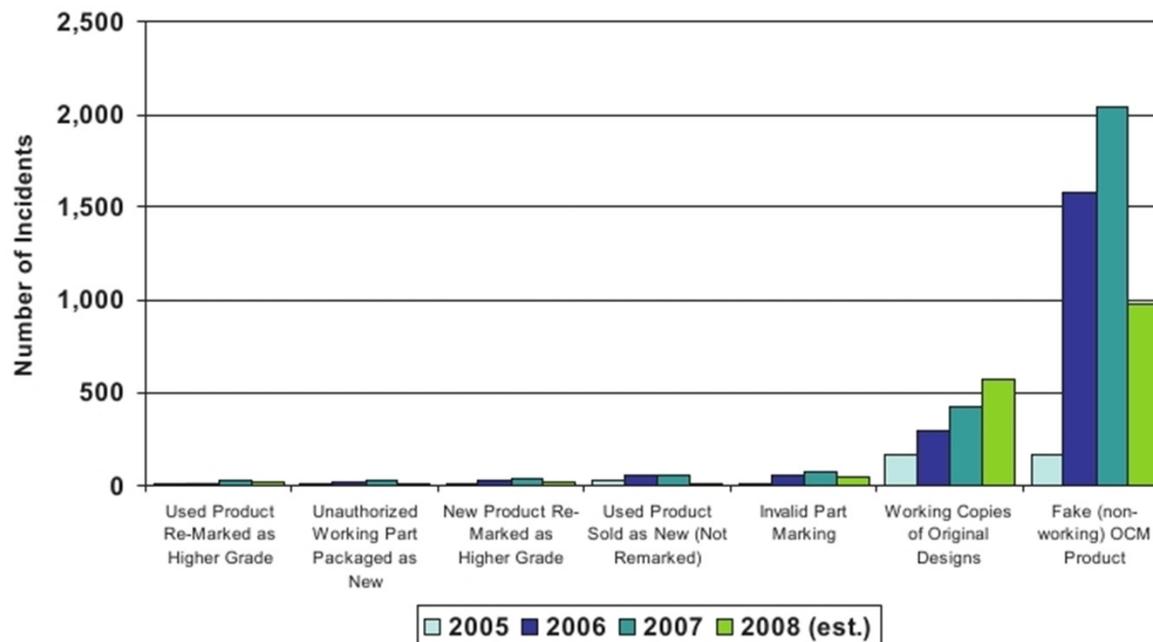
* DEFENSE INDUSTRIAL BASE ASSESSMENT: COUNTERFEIT ELECTRONICS PREPARED BY US DEPT OF COMMERCE BUREAU OF INDUSTRY AND SECURITY

June 2011



Awareness Training

Figure VII-12: Counterfeit Incidents by Type of Problem – Discretes (2005-2008)



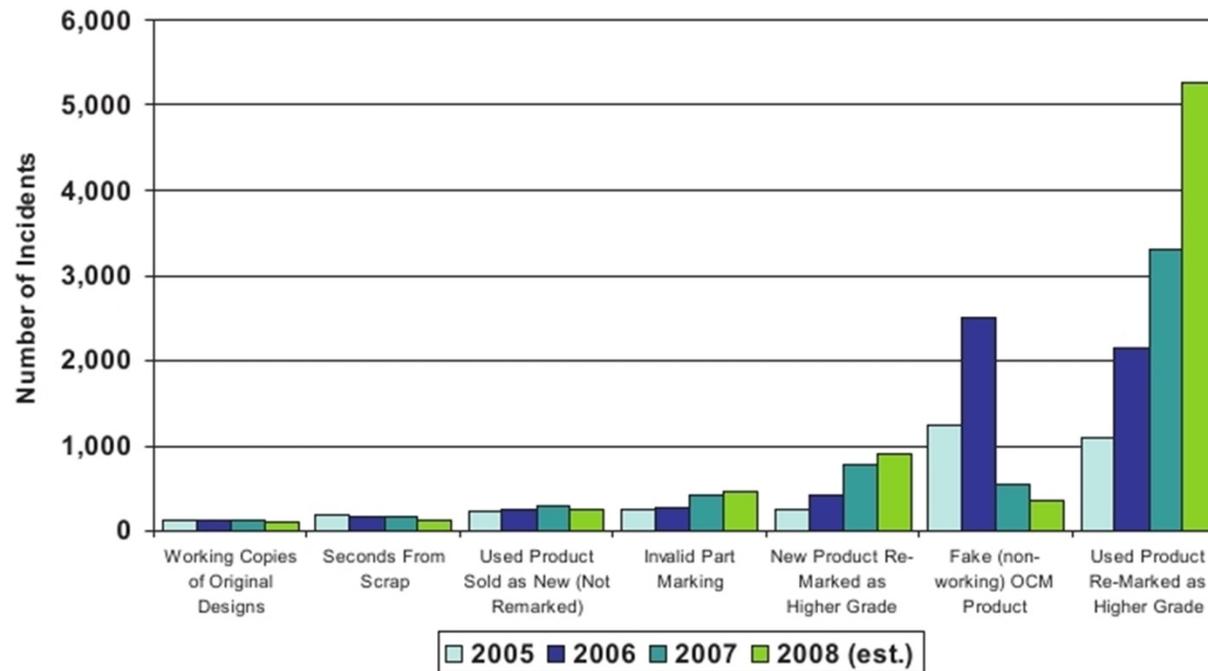
Source: U.S. Department of Commerce, Office of Technology Evaluation, Counterfeit Electronics Survey, November 2009.



Awareness Training

Counterfeit Parts Avoidance Training

Figure VII-13: Counterfeit Incidents by Type of Problem – Microcircuits (2005-2008)



Source: U.S. Department of Commerce, Office of Technology Evaluation, *Counterfeit Electronics Survey*, November 2009.

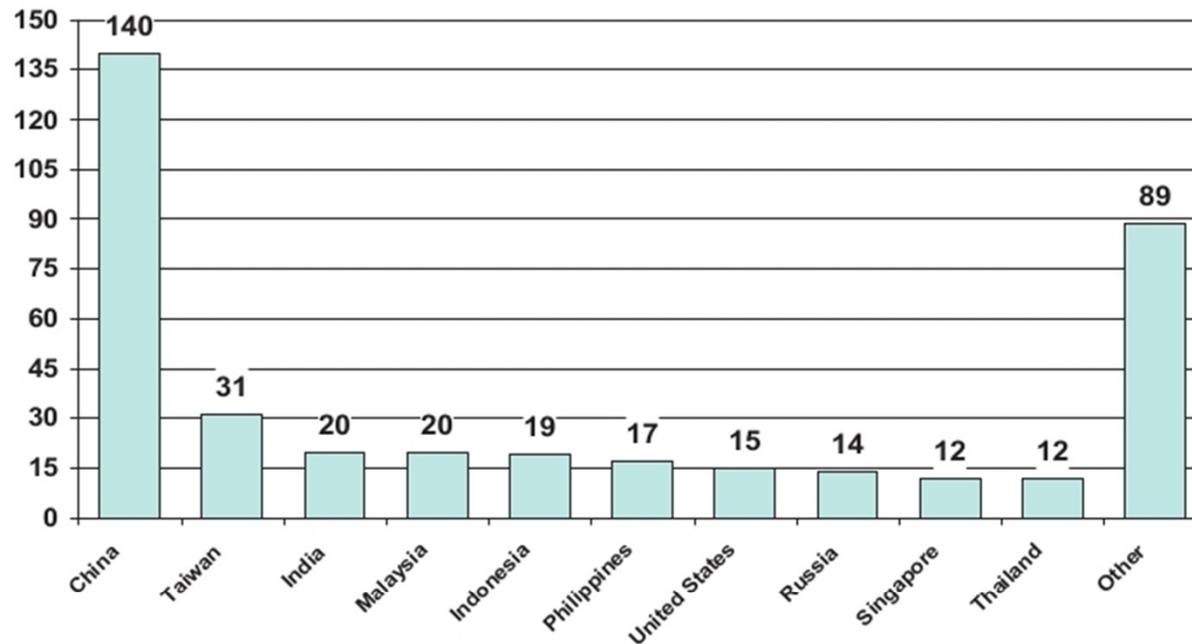


Awareness Training

Counterfeit Parts Avoidance Training

► Where are the parts being counterfeited?

Figure VII-15: Top Countries Suspected/Confirmed to be Sources of Counterfeits*



* Each company was asked to provide their top five suspected countries

Source: U.S. Department of Commerce, Office of Technology Evaluation,
Counterfeit Electronics Survey, November 2009.

* DEFENSE INDUSTRIAL BASE ASSESSMENT: COUNTERFEIT ELECTRONICS PREPARED BY US DEPT OF COMMERCE BUREAU OF INDUSTRY AND SECURITY

June 2011



National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology

Awareness Training

Counterfeit Parts Avoidance Training

- ▶ **How : A more sophisticated approach - the MVP Micro story.**

[click here for presentation](#)



June 2011



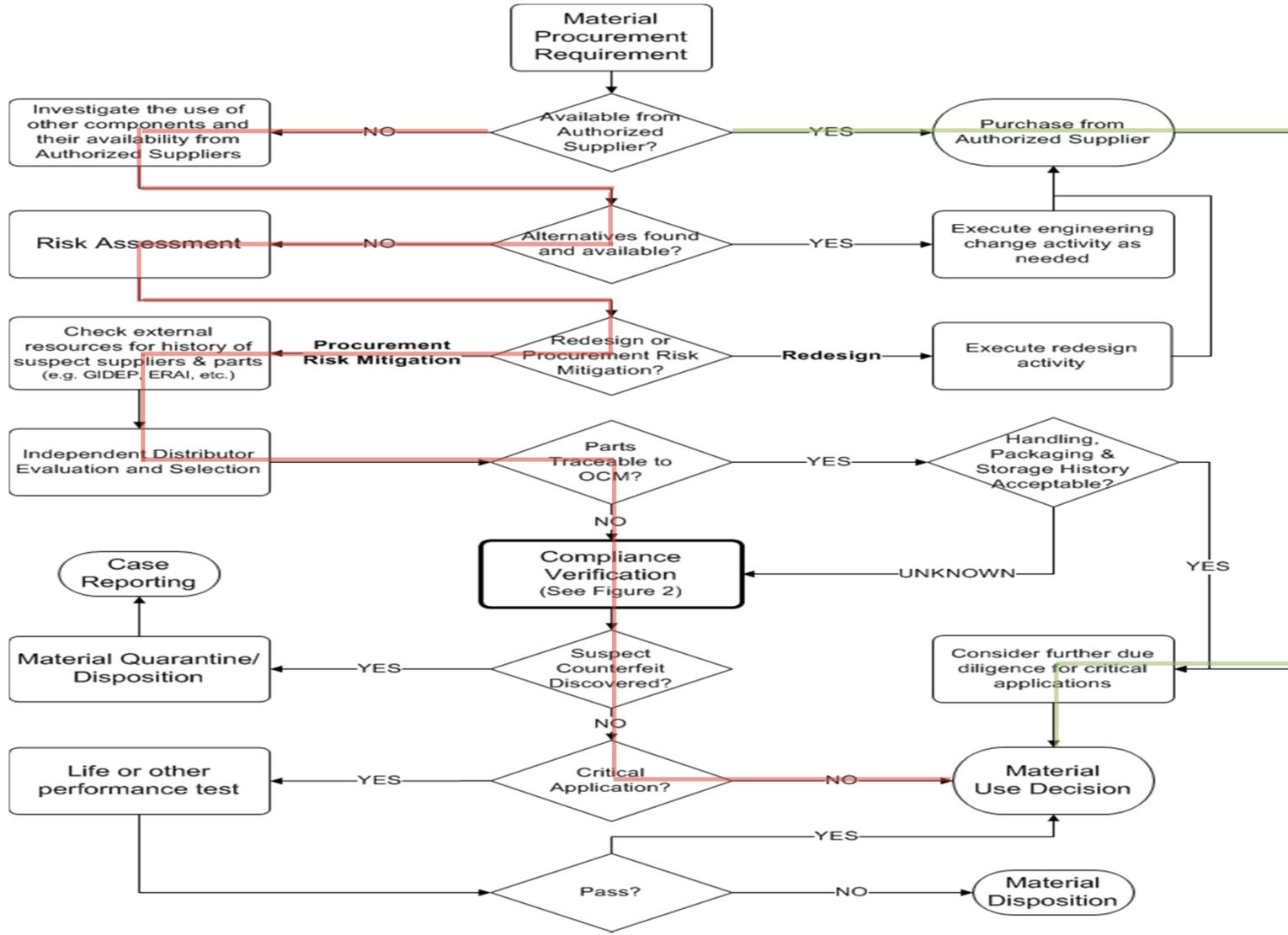
Risk Mitigation

Counterfeit Parts Avoidance Training

- ▶ Overview – risk mitigation, heritage design, supply chain risk ladder
- ▶ AS5553 – Aerospace Standard Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition
- ▶ NASA Policy Directive
- ▶ Prevention
 - ▶ Approved Supplier List
 - ▶ Supplier Site Visits and Audits
- ▶ Compliance Verification
 - ▶ Documentation
 - ▶ Date Code/Lot Code
 - ▶ External Visual
 - ▶ Packaging
 - ▶ Indents
 - ▶ Pins
 - ▶ Marking Permanency
 - ▶ X-Ray
 - ▶ X-Ray Fluorescence
 - ▶ Thermal Cycle Testing
 - ▶ Electrical Testing
 - ▶ Burn-In
 - ▶ Leak Testing



Risk Mitigation



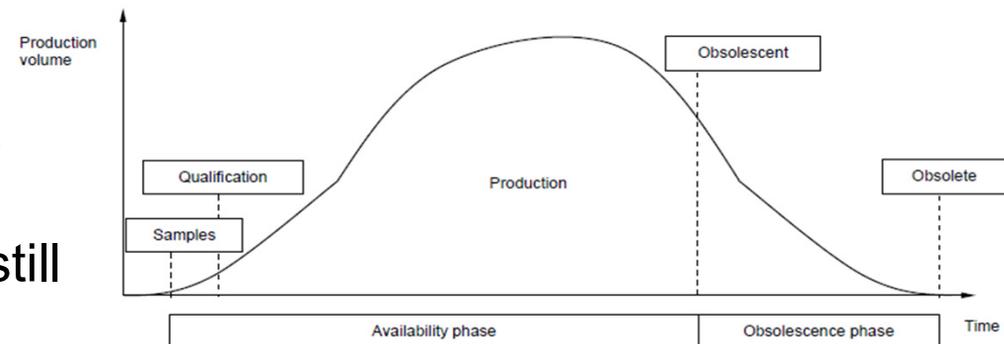
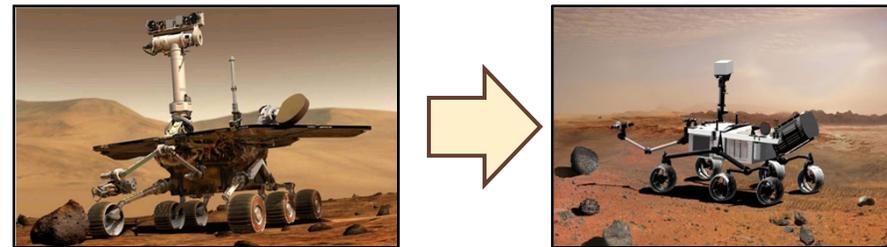


Danger of Heritage Designs

Counterfeit Parts Avoidance Training

- ▶ Obsolescence phase begins immediately after information about discontinuance is issued and product is considered obsolescent. This could be a product discontinuance notice (PDN), end-of-life (EOL) notification or lifetime buy (LTB) notification or a product change notice (PCN)
- ▶ A component may be considered obsolete once it is no longer available from the OCM, even though parts are still in the supply chain

MER Heritage on MSL

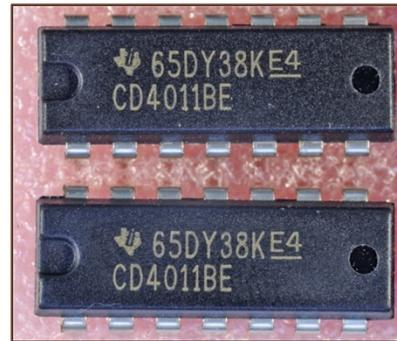




Danger of Heritage Designs

Counterfeit Parts Avoidance Training

Use of old/obsolete parts



Heritage designs increase common risk factors!

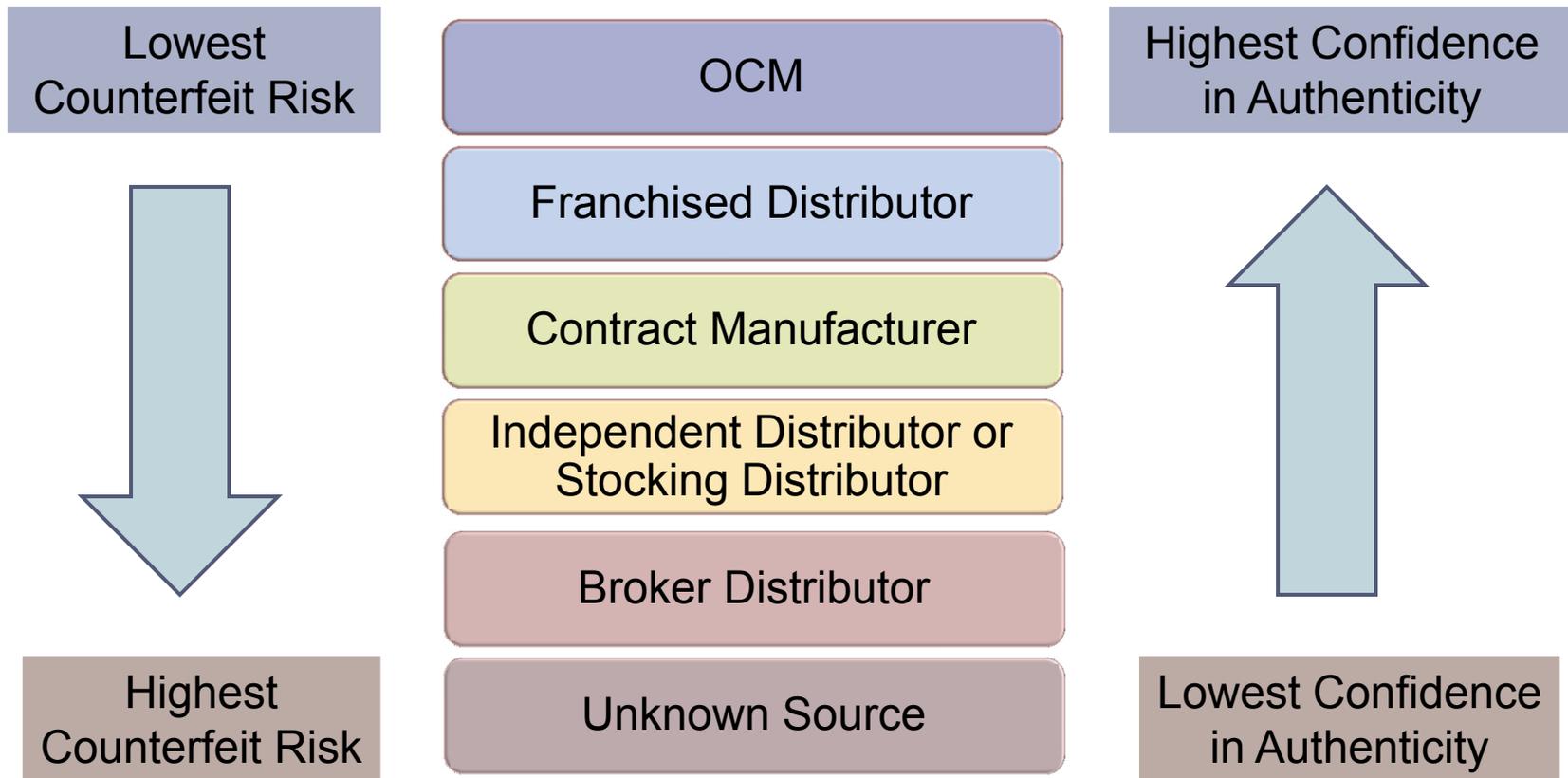
- Heritage design is an issue for DoD and Aerospace
 - may require the use obsolete parts
 - open market may be the only source = increased risk



Risk Ladder

Counterfeit Parts Avoidance Training

Counterfeit Risk and Confidence in Authenticity*



▶ * SAE Aerospace Standard AS5553: Counterfeit Electronic Components; Avoidance, Detection, Mitigation, and Disposition



Risk Mitigation- AS5553

Counterfeit Parts Avoidance Training

- ▶ This SAE Aerospace Standard standardizes practices to:
 - ▶ a. maximize availability of authentic parts,
 - ▶ b. procure parts from reliable sources,
 - ▶ c. assure authenticity and conformance of procured parts,
 - ▶ d, control parts identified as counterfeit,
 - ▶ e. and report counterfeit parts to other potential users and Government investigative authorities.
- ▶ Requirements
 - ▶ Counterfeit Control Plan implementation
 - ▶ Parts Availability – Design Stage, Obsolescence Management



Risk Mitigation- AS5553

- ▶ Parts Procurement
 - Assess potential sources of supply (look at audit example)
 - Maintain a register of [approved suppliers](#)
 - Specify a preference to procure directly from OCMs or authorized suppliers on the approved supplier list
 - Assure suppliers are maintaining effective processes for mitigating the risks of supplying counterfeit electronic parts (example [1,2](#))
 - Assess and mitigate risks of procuring counterfeit parts from sources other than OCMs or authorized suppliers
 - ([assessment1](#), [assessment1](#), [exemption example](#))
 - Specify supply chain traceability to the OCM or aftermarket manufacturer (example [1,2](#))
 - Specify flow down of applicable requirements of this document to applicable contractors and their sub-contractors



Risk Mitigation- AS5553

Counterfeit Parts Avoidance Training

- ▶ The documented processes shall assure detection of counterfeit parts prior to formal product acceptance
- ▶ Inspection: The documented processes shall address the detection, verification, and control of in-process (post acceptance) and in service suspect counterfeit parts.
- ▶ Material Control – Control of suspect or confirmed counterfeit
 - a. Physically identify the parts as suspect/counterfeit product (e.g., tag, label, mark).
 - b. Physically segregate the parts from acceptable non-suspect parts and place in quarantine. Quarantine should consist of physical barriers and controlled access.
 - c. Do not return the parts to the supplier for refund, replacement, etc., except under controlled conditions which would preclude resale of the suspect counterfeit parts into the supply chain, and to allow the supplier to conduct internal investigation.



Risk Mitigation- AS5553

Counterfeit Parts Avoidance Training

- d. Confirm the authenticity of the parts. This may include further part-level testing, communications with the part's supposed OCM, third-party analysis, etc.
- e. Upon confirmation that a part is counterfeit, identify and place on "Hold" all potential additional counterfeit parts in storage and installed in product pending disposition by appropriate authorities.
- f. Report counterfeit parts
- ▶ Reporting
 - Upon identification of suspect or confirmed counterfeit parts, the organization should provide timely notification to the Government Industry Data Exchange Program (GIDEP), ERAI, and to applicable US Government investigative authorities and law enforcement agencies.



Risk Mitigation- NPD8730.2

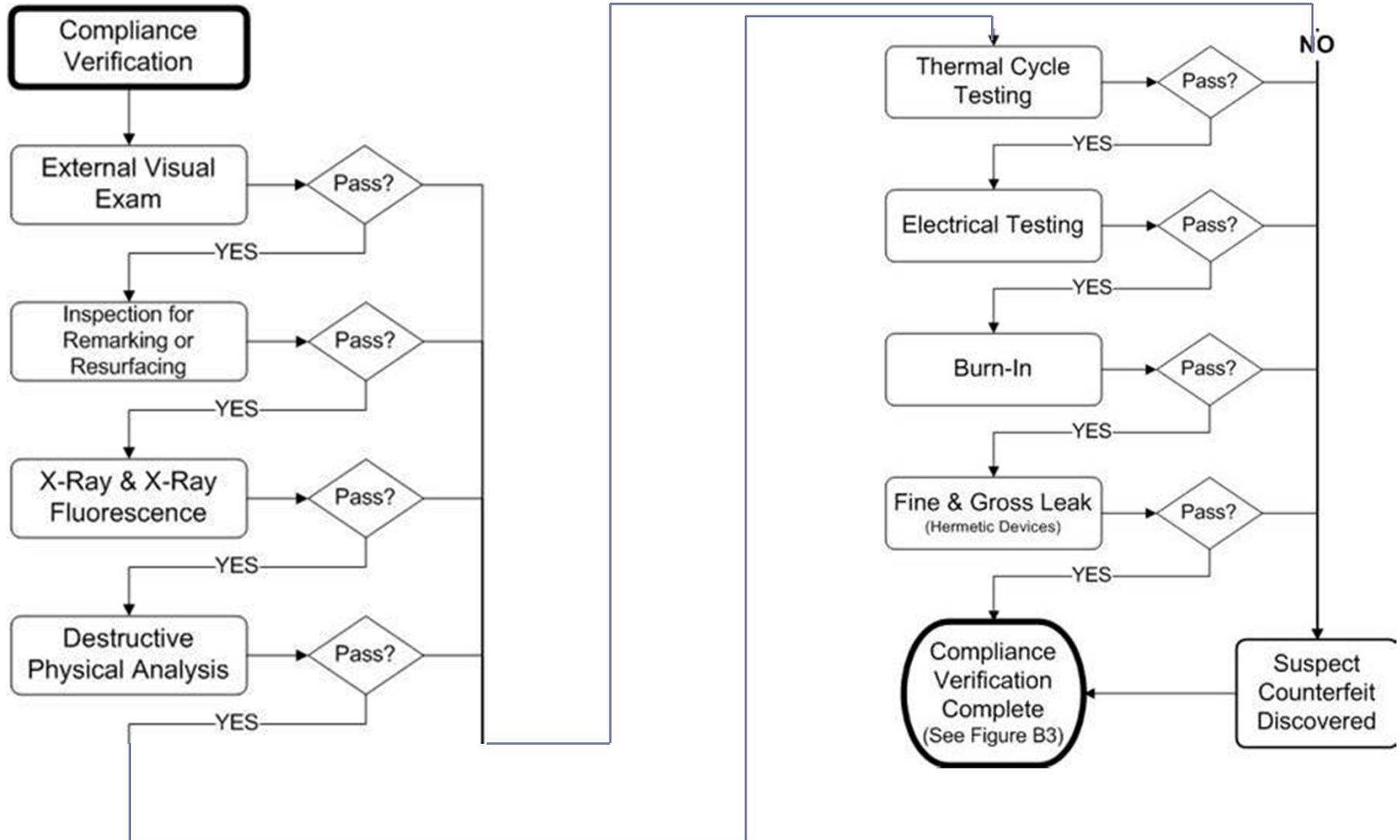
Counterfeit Parts Avoidance Training

- ▶ It is NASA policy to control risk and enhance reliability in NASA spaceflight and critical ground support/test systems, in part, by managing the selection, acquisition, traceability, testing, handling, packaging, storage, and application of the following:
 - ▶ a. Electrical, electronic, and electromechanical (EEE) parts.
 - ▶ b. Electronic packaging and interconnect systems.
- ▶ **Requirements**
 - ▶ Counterfeit Control Plan implementation
 - ▶ Parts Availability – Design Stage, Obsolescence Management
 - ▶ Procurement
 - ▶ Product Assurance
 - ▶ Material Control and Disposition
 - ▶ Reporting



Compliance Verification

Counterfeit Parts Avoidance Training





Compliance Verification

Counterfeit Parts Avoidance Training

Compliance Verification

Documentation

Inconsistencies

Date Code/Lot Code

General

Physical features – product of the mold

External Visual

Part Surface

damage, surface finish inconsistencies, blacktop

Part Markings/identification

permanency, correctness

Indents

clean – no blacktop, paint stripe

Pins

bent, tinning, lead forming marks, contamination



Compliance Verification

Counterfeit Parts Avoidance Training

Compliance Verification (continued)

[Marking Permanency](#)

[X-Ray](#)

[X-Ray Fluorescence](#)

[CSAM](#)

[Thermal Cycle Testing](#)

Electrical Testing

Burn-In

Leak Testing

Hands On Exercise – Visual Inspection revisited



Addendum

Counterfeiters are always one step ahead, new methods include:

- Taking existing good commercial part, making it industrial grade, removing marking via laser ablation, then remarking –difficult to detect!
- Microblaster/ sand blaster, removes even surface – difficult to detect!
- Removal of existing ink mark, no residue left, refined process – normal counterfeit detection will not work! Need to find a signature.

Will counterfeiters come up with new blacktopping techniques that will bypass, for example, the aggressive solvents technique or acoustic microscopy?



Contact Info

- ▶ Suggestions, comments or questions pertaining to the material presented should be directed to:

Carlo Abesamis – Procurement Quality Assurance

(818) 354-0211

abesamis@jpl.nasa.gov

Phil Zulueta – Manager, Hardware Technology Assurance

(818)354-1566

phillip.j.zulueta@jpl.nasa.gov

- ▶ Counterfeit Parts Working Group Website :

http://atpo.jpl.nasa.gov/counterfeit_parts.html

- ▶ Assurance Technology Program Office



Appendix



Terms and Definitions -Exercise

Counterfeit Parts Avoidance Training



Is this part a suspect part or counterfeit?

- **The part is suspect.**
- **Whether this part is counterfeit depends on subsequent investigation findings.**

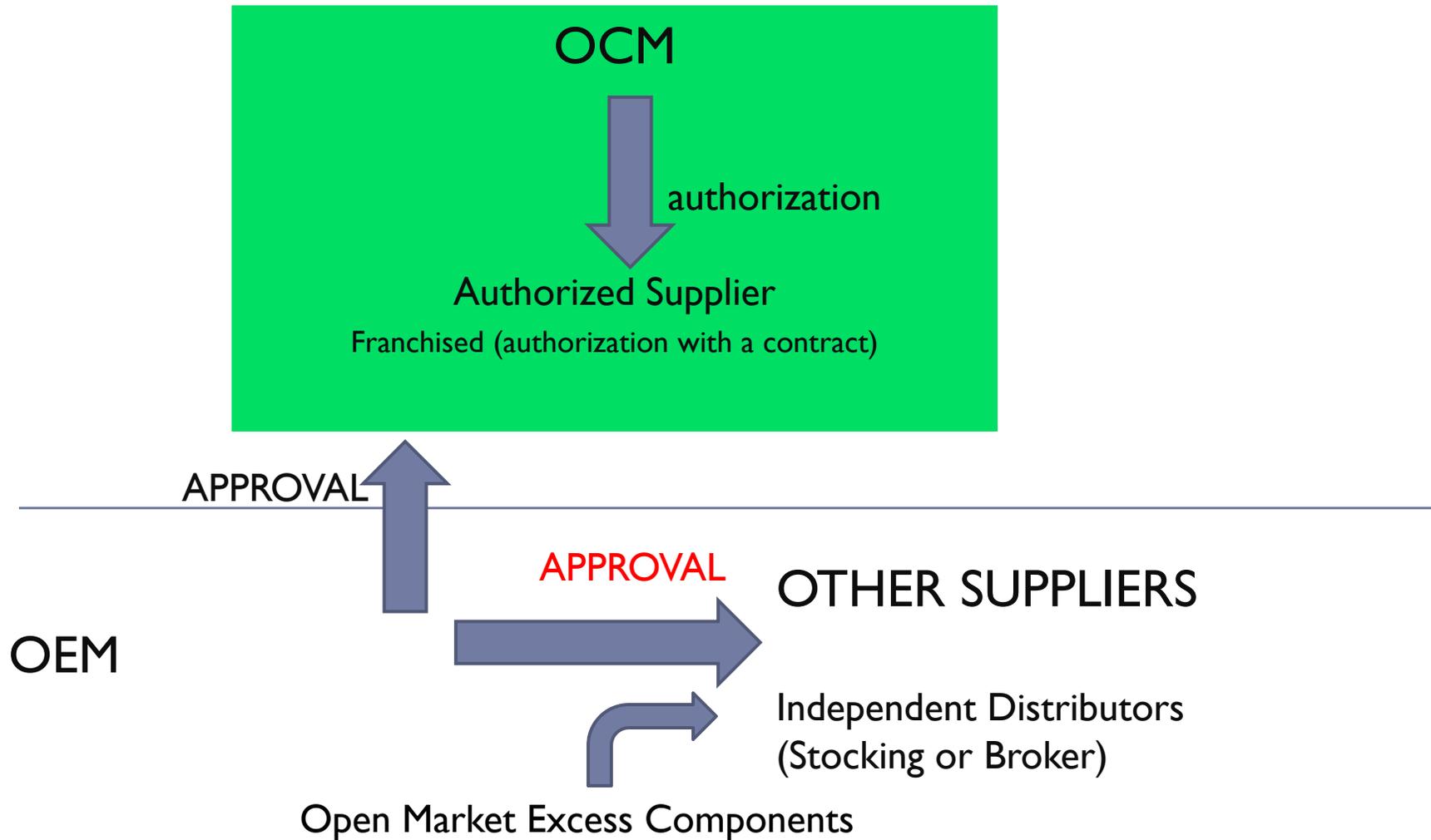
[Click here to return to main presentation](#)

▶ * "Trilateral Safety and Mission Assurance Conference," Brian Hughitt-NASA, April 2008



Terms and Definitions -Exercise

Counterfeit Parts Avoidance Training



[Click here to return to main presentation](#)



Uprating Example

Counterfeit Parts Avoidance Training

- ▶ **Military Grade part**
 - ▶ Rated over a wider temperature range than commercial or industrial parts
 - ▶ Demand often not large enough to induce manufacturers to continue fabrication
 - ▶ Obsolescence potential and challenge
- ▶ **Obsolescence Mitigation options**
 - ▶ Life time buys, part substitution, alternate part, design refresh, redesign, procure from independent distribution, reclaim
 - ▶ Uprating
 - ▶ AD5962 -8754001CA and AD585 Example

- ▶ Pecht, Humphrey , "Addressing Obsolescence – The Uprating Option", IEE Transactions on Components and Packaging Technologies, V31, No. 3, September 2008

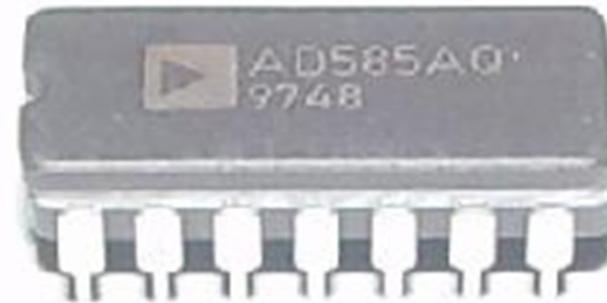
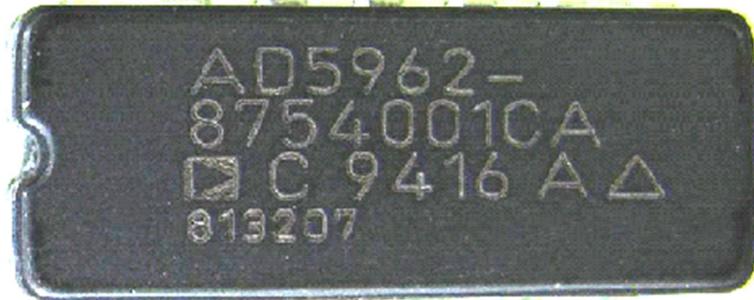
June 2011



Upgrading Example

Counterfeit Parts Avoidance Training

These two are essentially the same part
Both Analog Device's AD585 Amplifier



- ▶ Meets Requirements of DSCC specification 5962-87540
- ▶ Military Grade Quality Assurance Level
- ▶ Costs more than Industrial Grade

- ▶ Industrial Grade Quality Assurance Level
- ▶ Costs less than Military Grade

▶ *Tautec Electronics website

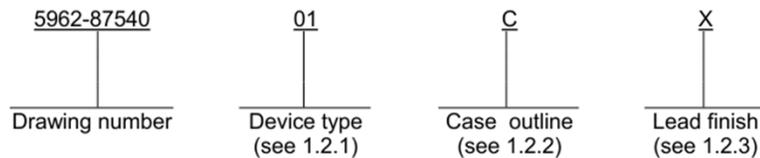


Upgrading Example AD5962-87540 Drawing

1. SCOPE

1.1 Scope. This drawing describes device requirements for MIL-STD-883 compliant, non-JAN class level B microcircuits in accordance with MIL-PRF-38535, appendix A.

1.2 Part or Identifying Number (PIN). The complete PIN is as shown in the following example:



1.2.1 Device type(s). The device type(s) identify the circuit function as follows:

<u>Device type</u>	<u>Generic number</u>	<u>Circuit function</u>
01	AD585	High speed, sample and hold amplifier

1.2.2 Case outline(s). The case outline(s) are as designated in MIL-STD-1835 and as follows:

<u>Outline letter</u>	<u>Descriptive designator</u>	<u>Terminals</u>	<u>Package style</u>
C	GDIP1-T14 or CDIP2-T14	14	Dual in line
2	CQCC1-N20	20	Square leadless chip carrier

1.2.3 Lead finish. The lead finish is as specified in MIL-PRF-38535, appendix A.

1.3 Absolute maximum ratings.

1.4 Recommended operating conditions.

Positive supply voltage (+V _S)	+5 V dc to +18 V dc
Negative supply voltage (-V _S)	-12 V dc to -18 V dc
Ambient operating temperature range (T _A)	-55°C to +125°C





Upgrading Example AD585 Data Sheet

ANALOG INPUT CHARACTERISTICS										
Offset Voltage	5			2			2			mV
Offset Voltage, T _{MIN} to T _{MAX}	6			3			3			mV
Bias Current	2			2			2			nA
Bias Current, T _{MIN} to T _{MAX}	5			5			20			nA
Input Capacitance, f = 1 MHz	10			10			10			pF
Input Resistance, Sample or Hold 20 V p-p Input, A = +1	10 ¹²			10 ¹²			10 ¹²			
DIGITAL INPUT CHARACTERISTICS										
TTL Reference Output	1.2	1.4	1.6	1.2	1.4	1.6	1.2	1.4	1.6	V
Logic Input High Voltage T _{MIN} to T _{MAX}	2.0			2.0			2.0			V
Logic Input Low Voltage T _{MIN} to T _{MAX}	0.8			0.8			0.7			V
Logic Input Current (Either Input)	50			50			50			αA
POWER SUPPLY CHARACTERISTICS										
Operating Voltage Range	+5, -10.8		±18	+5, -10.8		±18	+5, -10.8		±18	V
Supply Current, R _L = ∞	6		10	6		10	6		10	mA
Power Supply Rejection, Sample Mode	70			70			70			dB
TEMPERATURE RANGE										
Specified Performance	0		+70	-25	+85		-55		+125	°C
PACKAGE OPTIONS ^{3,4}										
Cerdip (Q-14)				AD585AQ			AD585SQ			
LCC (E-20A)							AD585SE			
PLCC (P-20A)	AD585JP									

NOTES

¹Maximum input signal is the minimum supply minus a headroom voltage of 2.5 V.

²Not tested at -55°C.

³E = Leadless Ceramic Chip Carrier; P = Plastic Leaded Chip Carrier; Q = Cerdip.

⁴For AD585/883B specifications, refer to Analog Devices Military Products Databook.

Specifications subject to change without notice.

Specifications shown in **boldface** are tested on all production units at final electrical test. Results from those tests are used to calculate outgoing quality levels.

All min and max specifications are guaranteed, although only those shown in **boldface** are tested on all production units.

[Click here to return to main presentation](#)



AD585 Revisited

Counterfeit Parts Avoidance Training

WORLD LEADER IN HIGH PERFORMANCE SIGNAL PROCESSING

ANALOG DEVICES

Sample & Purchase | View Cart | Sales & Distributors | Quality

PRODUCTS APPLICATIONS RESOURCES & TOOLS ABOUT ADI MY ANALOG

Enter keywords or part #

AD585: Complete Monolithic SHA Circuit.

Product Status: Production

DATA SHEET

Download Data Sheet Rev A, 042002 (pdf 33kb)

Additional Data Sheets (About Data Sheets)

Technical Documentation

Quality and Reliability Information

Similar Products

SPECIFICATIONS

- # Channels: 1
- Supply Voltage (V): +/-12, +/-15
- Acquisition Time (to 01%): 3µs
- Aperture Jitter: 0.5ns
- Droop Rate: 1mV/ms
- Slew Rate (V/µs): 10
- Temp Range (°C): 55 to 125.0 to 70
- 25 to 85
- Package: PLCC, PDIP, LCC

PIN CONFIGURATION FOR AD585

DIP LCC/PLCC Package

SIMILAR PRODUCTS: View Interactive Product Selection Table

SAMPLES & PURCHASE | PACKAGING

AD585 Model Options

Model	Status	Package	Pins	Temp. Range	Price* (100-499)	Price* (1000 pcs.)	Packing / Qty
5962-87540012A	Prodn	20 Id LCC	20	Mil	\$79.75	\$72.08	Tube, 54
5962-8754001CA	Prodn	14 Id CerDIP	14	Mil	\$84.32	\$76.21	Tube, 25
AD585ACHIPS	Prodn	CHIPS OR DIE	-	Ind	\$10.30	\$10.30	Tray, 100
AD585AQ	Not Rec**	14 Id CerDIP	14	Ind	\$22.43	\$20.30	Tube, 25
AD585JP	Not Rec**	20 Id PLCC	20	Comm.	\$20.53	\$18.55	Tube, 49
AD585JP-REEL	Not Rec**	20 Id PLCC	20	Comm.	-	\$18.55	Reel, 1000
AD585JP-REEL7	Contact ADI	20 Id PLCC	20	-	-	-	Reel, 250
AD585JPZ	Not Rec**	20 Id PLCC	20	Comm.	\$18.70	\$16.91	Tube, 49
AD585JPZ-REEL7	Not Rec**	20 Id PLCC	20	Comm.	-	\$16.91	Reel, 250
AD585SCHIPS	Prodn	CHIPS OR DIE	-	Mil	\$36.77	\$36.77	Tray, 100
AD585SE	Prodn	20 Id LCC	20	Mil	\$59.81	\$54.04	Tube, 54
AD585SE/833B	Prodn	20 Id LCC	20	Mil	\$80.68	\$72.92	Tube, 54
AD585SQ	Prodn	14 Id CerDIP	14	Mil	\$62.04	\$56.10	Tube, 25
AD585SQ/833B	Prodn	14 Id CerDIP	14	Mil	\$80.65	\$72.91	Tube, 25

SAMPLES & PURCHASE | PACKAGING

AD585 Model Options

Model	Status	Package	Pins	Temp. Range	Price* (100-499)	Price* (1000 pcs.)	Packing / Qty
5962-87540012A	Prodn	20 Id LCC	20	Mil	\$79.75	\$72.08	Tube, 54
5962-8754001CA	Prodn	14 Id CerDIP	14	Mil	\$84.32	\$76.21	Tube, 25
AD585ACHIPS	Prodn	CHIPS OR DIE	-	Ind	\$10.30	\$10.30	Tray, 100
AD585AQ	Not Rec**	14 Id CerDIP	14	Ind	\$22.43	\$20.30	Tube, 25
AD585JP	Not Rec**	20 Id PLCC	20	Comm.	\$20.53	\$18.55	Tube, 49
AD585JP-REEL	Not Rec**	20 Id PLCC	20	Comm.	-	\$18.55	Reel, 1000
AD585JP-REEL7	Contact ADI	20 Id PLCC	20	-	-	-	Reel, 250
AD585JPZ	Not Rec**	20 Id PLCC	20	Comm.	\$18.70	\$16.91	Tube, 49
AD585JPZ-REEL7	Not Rec**	20 Id PLCC	20	Comm.	-	\$16.91	Reel, 250
AD585SCHIPS	Prodn	CHIPS OR DIE	-	Mil	\$36.77	\$36.77	Tray, 100
AD585SE	Prodn	20 Id LCC	20	Mil	\$59.81	\$54.04	Tube, 54
AD585SE/833B	Prodn	20 Id LCC	20	Mil	\$80.68	\$72.92	Tube, 54
AD585SQ	Prodn	14 Id CerDIP	14	Mil	\$62.04	\$56.10	Tube, 25
AD585SQ/833B	Prodn	14 Id CerDIP	14	Mil	\$80.65	\$72.91	Tube, 25



- Which is the more likely counterfeit candidate?
- price, obsolescence,

<http://www.analog.com/en/other-products/sampletrack-and-hold-amplifiers/ad585/products/product.html>

[Click here to return to main presentation](#)

June 2011



Awareness - Who

Counterfeit Parts Avoidance Training

Who is this person?



[Click here to return to main presentation](#)



Awareness - Who

Counterfeit Parts Avoidance Training

Man accused of selling counterfeit microchips had a passion for drag racing

By Stephen Nohlgren and William Levesque, Times Staff Writers
In Print: Thursday, September 16, 2010

Shannon Wren has a taste for fast and fancy cars.

In his youth, he and other late-night thrill seekers liked to block off the Gandy Bridge and race across the bay.

Two years ago, he made drag racing history in his green Mustang by hitting 200 mph without crashing.

And earlier this week, when federal agents descended on his mid-Pinellas computer components company, they confiscated a Ferrari, a Mercedes and a Bentley.

Wren, 42, was indicted this week by a federal grand jury in Washington on charges that he sold \$16 million worth of counterfeit computer chips to the U.S. Navy and some of its weapons contractors.

The chips were supposed to be brand name, "military grade" integrated circuits, the indictment said, but in fact were counterfeits from China and Hong Kong.

Though these specific chips may not have made their way into weapons systems, the indictment says, counterfeits potentially "put lives and property at risk" and can serve as tiny Trojan horses, allowing hackers to disrupt U.S. systems.

Wren, of 11200 Fifth Street E, Treasure Island, was unavailable for comment. He was being held Wednesday in the Pinellas County Jail for pick up by federal marshals.

A woman who answered the door at his Clearwater company, VisionTech Components, declined to comment, saying "nobody is interested in the truth."

Wren also owns Reborn Couture, a trendy apparel and accessories store in Tampa's SoHo district, along with Nevada Vanderford, who identified herself as his fiancee two years ago when the store opened. On Wednesday, a sign on the shop's door

said, "Closed for family emergency."

Family members and friends of Wren's either could not be reached or declined to comment. But various public records, websites and one acquaintance from Pinellas Park's SunShine Dragstrip filled in some of the blanks.

Wren was born in Mississippi and got his first driver's license there.

But "he has lived around here forever," said Rob Cossack, photographer at the dragstrip. "He had the reputation, like other local guys, of coming up from street racing" on the Gandy Bridge.

Later Wren competed in SunShine's "radial tire" division, a subset of "outlaw racing," which just means rules are looser and races aren't sanctioned by the National Hot Road Association.

Wren began gaining notice on Internet racing sites with "Project X," a souped up, spray painted 1993 Chevy Nova. Then he modified a 1995 twin-turbo Mustang and hit 200 mph at the 2008 Mid-South Street Shootout in Memphis, a drag-racing first.

"He was one of those guys who wanted to do something big," Cossack said. "He was certainly involved in building cutting-edge stuff."



Awareness - Who

Counterfeit Parts Avoidance Training

Man accused of selling counterfeit microchips had a passion for drag racing

By Stephen Nohlgren and William Levesque, Times Staff Writers

Wren is an amiable, generous man, Cossack said. If his company sold counterfeit chips, he said, "I wouldn't be surprised to find out that he didn't know about it."

VisionTech's website says it began operations in 2002 and carries a multimillion dollar inventory, with more than 4,000 line items and a specialty in obsolete and hard-to-find parts.

In his 2005 divorce, Wren valued VisionTech at \$1 million. As assets, he also listed 19 cars, trailers, trucks and motors worth \$474,500 and a \$12,000 boat.

The indictment says VisionTech sold about 60,000 counterfeit chips during 31 sales from 2007 through 2009. The chips carried brand names like Texas Instruments and Motorola, but were actually imports from China.

Military grade chips cost more and must withstand extreme temperatures and vibration. Some chips were intended for a ship-board antenna system that identifies friendly aircraft from enemy planes, the indictment said. Others were intended for ballistic missile control.

Two sales went to a California firm that resold one of the components to undercover federal investigators. The owner and manager of that firm have pleaded guilty to criminal charges and are cooperating with investigators, the indictment said.

Agents then made two undercover buys of counterfeit components directly from VisionTech, the indictment said, one in 2009 and the other this July.

In an e-mail statement, Defense Department spokeswoman Wendy Snyder said the military has several programs to identify counterfeit gear, including testing of critical components when the military takes possession of them.



Awareness - Who

Counterfeit Parts Avoidance Training

Man accused of selling counterfeit microchips had a passion for drag racing

By [Stephen Nohlgren](#) and William Levesque, Times Staff Writers
In Print: Thursday, September 16, 2010

They have found no cases "where counterfeit parts have caused failure of (Defense Department) missions, equipment, or placed our troops at risk," she wrote.

Robert Castro isn't so sure.

Castro, who owned American Data in Tampa, is a former Marine Corps intelligence officer. In 2004, he said, he unwittingly bought dozens of counterfeit, high-tech computer switches.

He bought them from a reputable Tampa Bay company, intending to resell them to Lockheed Martin for \$554,000. Lockheed, in turn, would sell them to the U.S. Navy. Some were even installed in submarines.

But Castro learned later the switches originated with sophisticated counterfeiters in China. The bad deal drove Castro's company into bankruptcy, he said.

Castro doesn't understand how the military can be so certain that counterfeits pose no security threat.

"Because the government and the military buys so much technology from so many sources, they don't have the scientists or the expertise to check everything. They just take the word of the vendor that the stuff is genuine."

Counterfeits are difficult to ferret out, he said, because the technology often works, even if not as reliably as genuine product might.



Awareness - Who

Counterfeit Parts Avoidance Training

Man accused of selling counterfeit microchips had a passion for drag racing

By [Stephen Nohlgren](#) and William Levesque, Times Staff Writers
In Print: Thursday, September 16, 2010

Wren is charged with conspiracy, trafficking in counterfeit goods and mail fraud. He could get up to 35 years in prison.

Also charged was VisionTech's manager, Stephanie McCloskey, of 2092 Whitney Place in Clearwater. She was released on \$25,000 bail, prosecutors said. She could not be reached Wednesday for comment.

Times staff writers Rodney Thrash, Shelley Rossetter, Jamal Thalji and researcher Caryn Baird contributed to this report.

[Last modified: Sep 16, 2010 12:12 PM]



[Click here for reuse options!](#)

Copyright 2010 St. Petersburg Times

[Click here to return to main presentation](#)



Contract Requirements Flowdown

Counterfeit Parts Avoidance Training

QC106 ELECTRICAL, ELECTRONIC, AND ELECTROMECHANICAL (EEE) PART TRACEABILITY:

Contractor shall provide traceability certificate(s) that trace EEE components back to the Original Component Manufacturer (OCM). The traceability certificate(s) shall identify every intermediary in the supply chain, starting from the OCM, ending at Contractor providing the EEE components to JPL.

QC02-N CERTIFICATE OF COMPLIANCE (C of C) [NASA AQC05]:

Contractor shall provide a certificate with each shipment to attest that the parts, assemblies, subassemblies, or detail parts conform to the Contract/Purchase Order requirements.

Certificate shall contain the following:

- JPL's Contract/Purchase Order number
- Line item number from the Contract/Purchase Order
- Part number as identified in the Contract/Purchase Order
- Name and address of manufacturing or processing location
- Manufacturer's lot number, heat lot number, batch number, date code, and/or serial number(s), if applicable
- Quantity and unit of measurement (each, box, case, gallons, etc.)
- Be signed and dated by Contractor representative

[Click here to return to main presentation](#)

JPL8



National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology

Counterfeit Parts Avoidance Training

AMERICAN ELECTRONIC RESOURCE, INC.



Manufactured Counterfeits

Charles Irvin and Robb Hammond
Corporate Headquarters
3505 Cadillac Avenue, Building A
Costa Mesa, CA 92626
www.aeri.com



Your Connection To The World's Electronic Component Inventory

AMERICAN ELECTRONIC RESOURCE

Discover the Difference

Slide 63

JPL8

lead frame
die attach
encapsulation
singulation
lead forming

Ask JPL parts - buy tinned?

Jet Propulsion Laboratory, 5/19/2011

INTRODUCTION

- The take down of MVP Micro
- Mass Production - amount and cost and profit
- Major steps of Manufactured Counterfeiting
- Finished product and dangers of Manufactured Counterfeiting
- Techniques to detect a Manufactured Counterfeit

HOW I WAS BROUGHT INSIDE

- Charles Irvin hired by MVP Micro in March 2009 as a Quality Control Engineering Technician
- Original job function to decap parts in order to detect counterfeits.
- Later asked to extract die from larger quantities to “refurbish”
- Realized the MVP owner’s idea of “refurbishment” was actually changing the part to another package and new markings.
- Began to realize the problems associated with the repackaging and the potential danger to life and property with the customers we were supporting (Navy)
- Shared my concerns with the owners of the company
- Secretly began to inform customers and authorities about what was happening at MVP
- October 6th 2009 MVP raided by NCIS (Navy Counter Intelligence Services)
- I was subpoenaed to appear in Washington DC to testify against the owners of the company
- Owners charged with conspiracy, counterfeit goods, and trafficking counterfeit parts. (among 9 other charges)

ARREST REPORT

Look what fraud results in:

- Two members of a Newport Beach family sentenced to prison after pleading guilty to selling counterfeit electronics to the military.
- Mustafa Abdul Aljaff, 30, of Newport Coast, and Neil Felahy, 32, pleaded guilty in federal court in Washington on Jan. 13, as part of a plea agreement with prosecutors for buying counterfeit semiconductors and selling them to the Navy as military-grade components.
- A third defendant, Neil's wife, Marwah Felahy, 32, was also charged. As part of a plea agreement with Neil Felahy, authorities dropped charges against Marwah, according to his plea agreement.
- Felahy faced up to three years in prison under federal sentencing guidelines. Aljaff sentenced up to two and a half years in prison as part of a plea agreement.



POTENTIAL PARTS IN SUPPLY CHAIN

- 8 operators x 325 pieces per day = 2600 daily
- 2600 parts x 5 days = 13,000 parts weekly
- 13,000 parts x 4 weeks = 52,000 monthly (approximately 15% were unable to be repackaged) YIELD ~ 45,000/MONTH
- The operation lasted around 9 months and started around January 2009 and Charles was terminated in September 2009.
- Over 400,000 produced and potentially still in supply chain. Where are they now?
- How many more production copycats are in China?
- The most popular part, ICM7170 IPG, was bought for \$.02 and on average sold for \$38.00 each as an ICM7170”A”IBG’s which equals a potential gross profit of \$2,000,000 per month.

ICM7170IPG vs ICM7170AIBG

ICM7170 is a Microprocessor-Compatible Real-Time Clock, Manufactured by Harris/Intersil

ICM7170IPG:

- 40C to 85C Temperature Range

- 24-Lead Plastic Dual-In-Line Package (PDIP)

- 20uA Maximum Standby Current at 32kHz

ICM7170AIBG:

- 40C to 85C Temperature Range

- 24-Pin Small Outline Plastic Package (SOIC)

- 5uA Maximum Standby Current at 32kHz

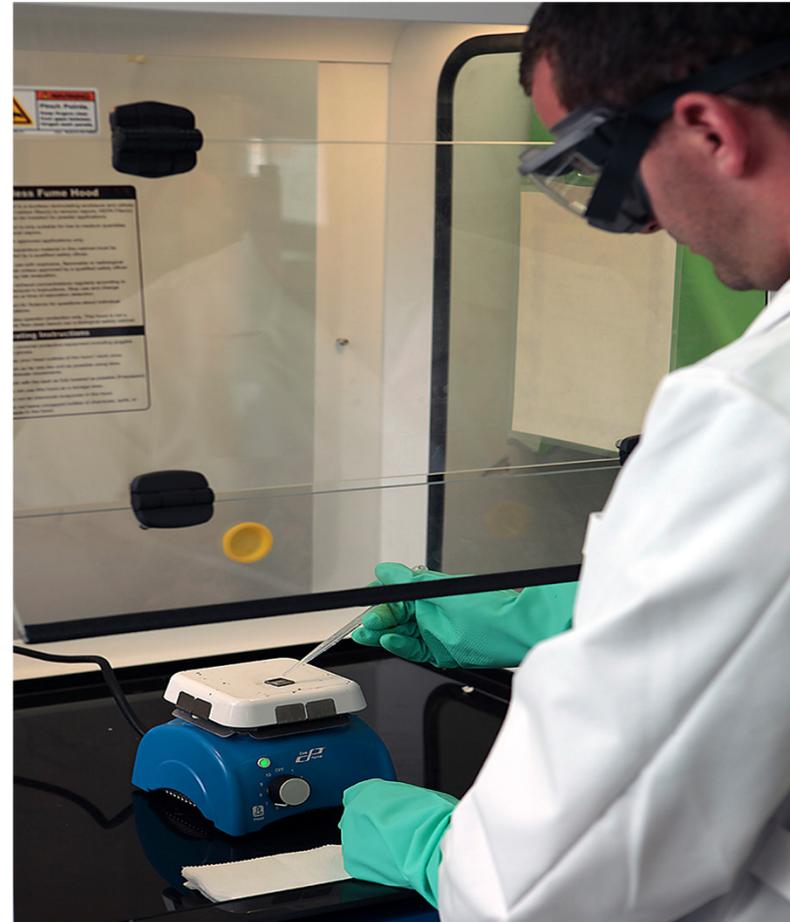
MANUFACTURING COUNTERFEITS

- The majority of parts used for this process appeared to be new parts which were purchased in China. They were most likely resurfaced.
- MVP typically manufactured counterfeits with the same manufacturer's die inside as was being printed on the outside, but in a different package and potentially different grade. Occasionally MVP would use a different manufacturer's die than was printed on the package.
- Parts were sent to be repackaged at CEI in Thailand. The parts were also labeled there.
- The counterfeits manufactured were hard to find parts which were typically expensive.

REPACKAGING A DIE

STEP 1- DECAPSULATION

- Decapsulation is the first step in the process to repackage the die.
- To harvest the quantities needed to make a profit, it can be a very dangerous and dirty process.
- The operators were put under pressure to perform which increases the chance for accidents with the toxic and oxidizing acids and their fumes.
- The chemicals used are very hard on the die and bonding pads.

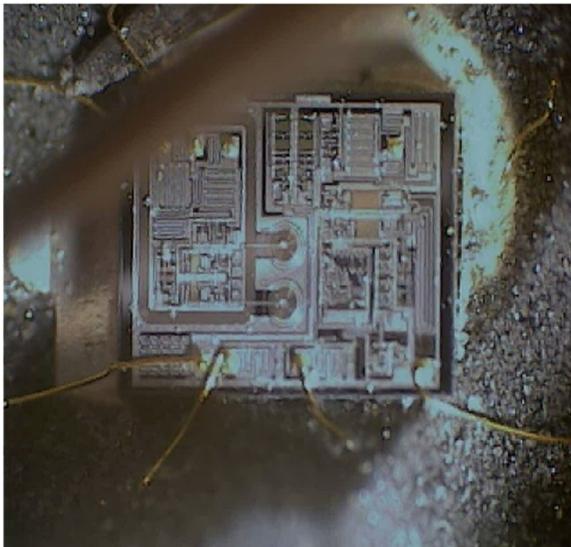


STEP 2 - BOND WIRE REMOVAL (PLUCKING)

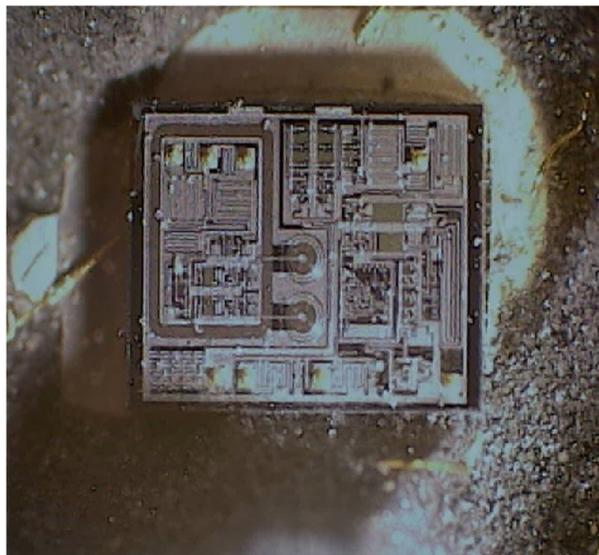
With precision tweezers and steady hands the operator must get under the wire and pull the wires the opposite direction of the ball bond attached to the pad.

Breaking the wire at the top of bonds of a decapped part is the most difficult part of the this process without damaging the original ball bond.

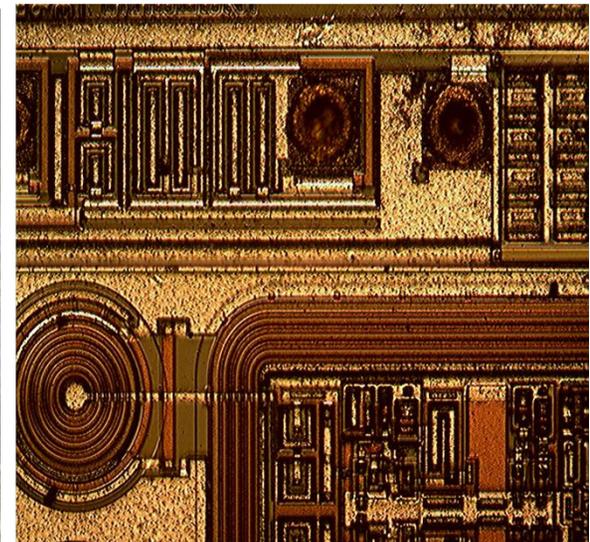
Plucking with tweezers



After plucking



Close up of bonding pad



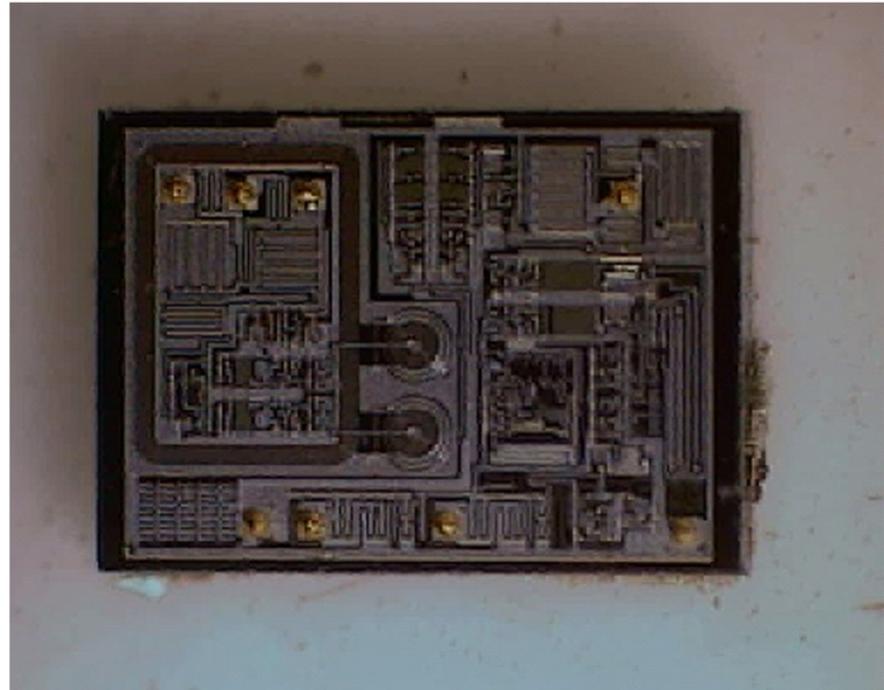
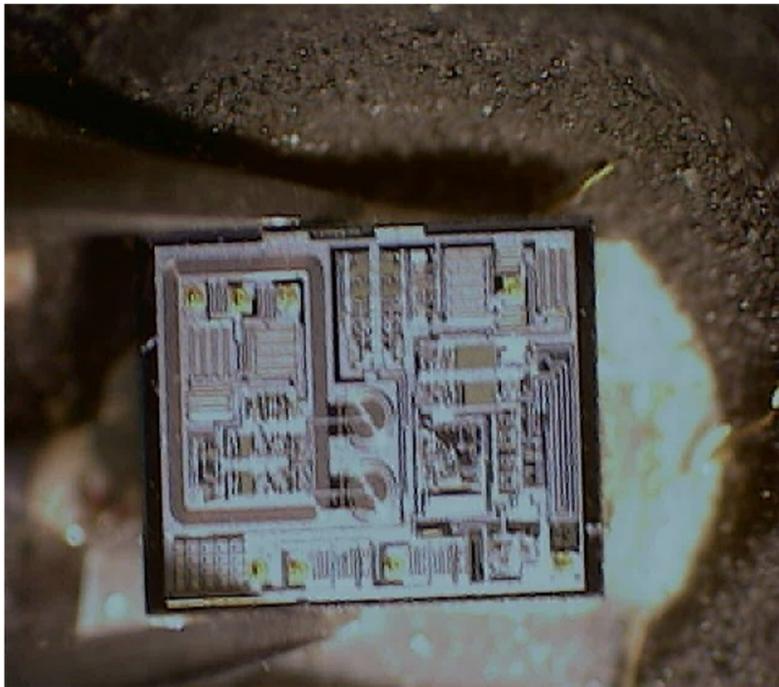
STEP 3 – CHIP REMOVAL (EXTRACTION)

To extract the die from the package and lead frame, the counterfeiter uses a hot plate not exceeding 100 degrees Centigrade to loosen the adhesive holding the die to the lead frame.



STEP 3 – CHIP REMOVAL (EXTRACTION)

The operator then uses an exacto knife and tweezers to pry the die gently off the lead frame or package mounting.



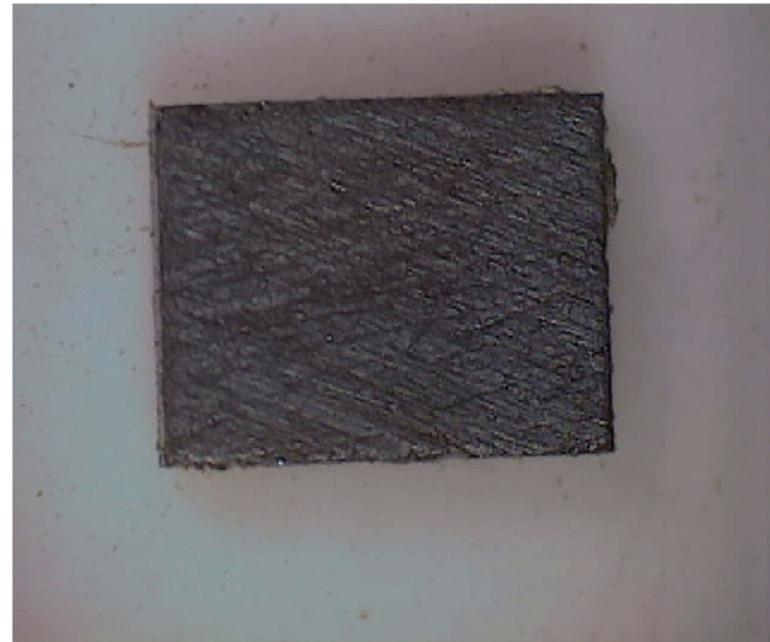
STEP 4 – REMOVING ADHESIVE BACKING

After the die is extracted the adhesive is left on the back of the die. The operator then sands the back to remove the adhesive leaving small abrasions that could later complicate the positioning of the die.

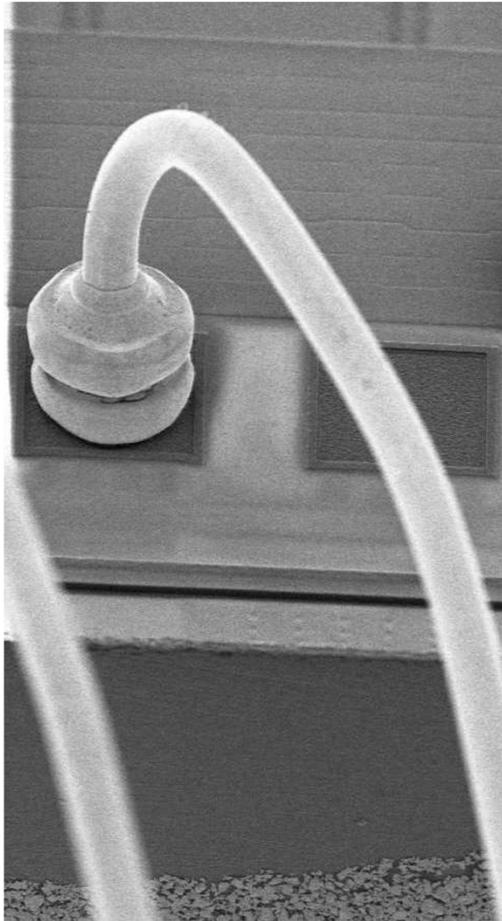
Die back with remaining adhesive



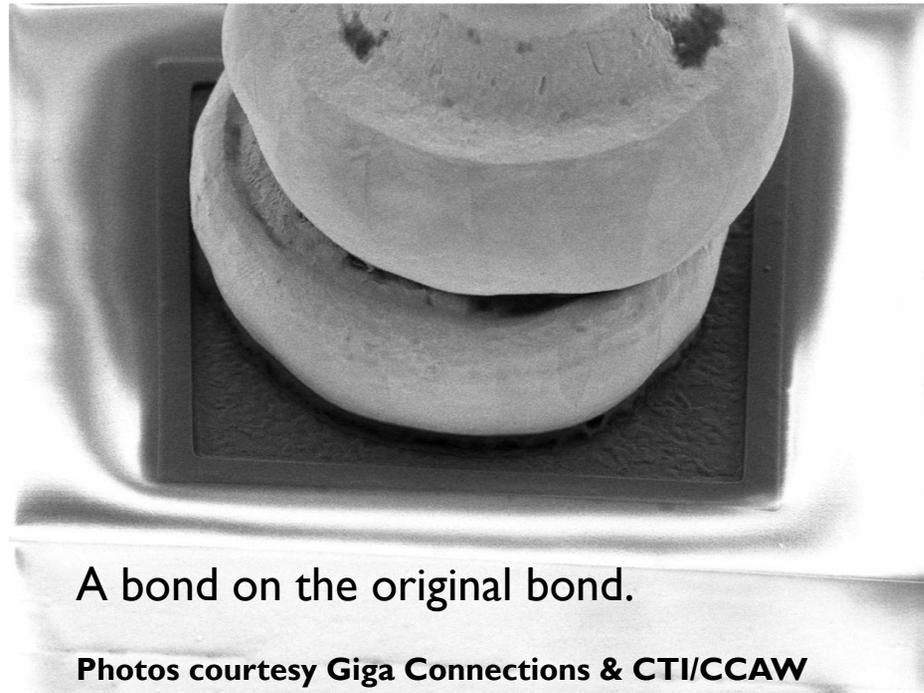
Die back after adhesive sanded off



STEP 5 – BONDING IN NEW PACKAGE



The new wire bond is placed on top of the old ball providing a signature showing what has transpired.



A bond on the original bond.

Photos courtesy Giga Connections & CTI/CCAW



• Your Connection To The World's Electronic Component Inventory

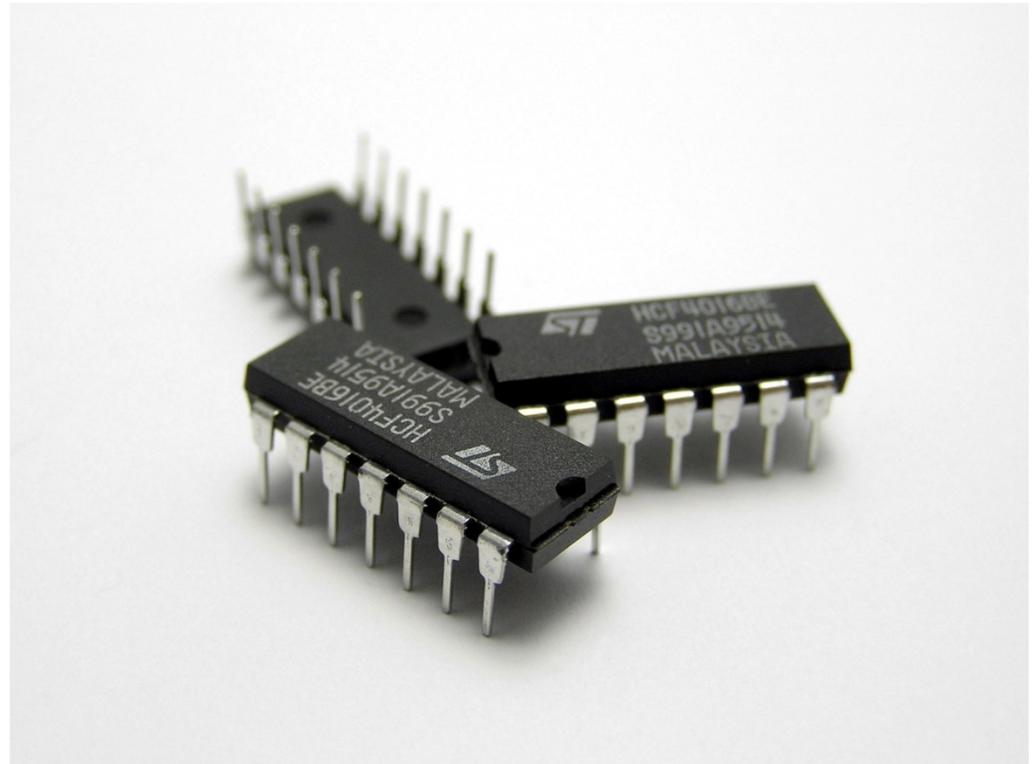
AMERICAN ELECTRONIC RESOURCE

Discover the Difference

FINISHED PRODUCT AND DANGERS OF MANUFACTURED COUNTERFEITS

The finished product can look like the original. Once the components are complete they may undergo a simple electrical test, such as a curve trace, but the stresses from reclaiming and die harvesting can induce severe damage causing;

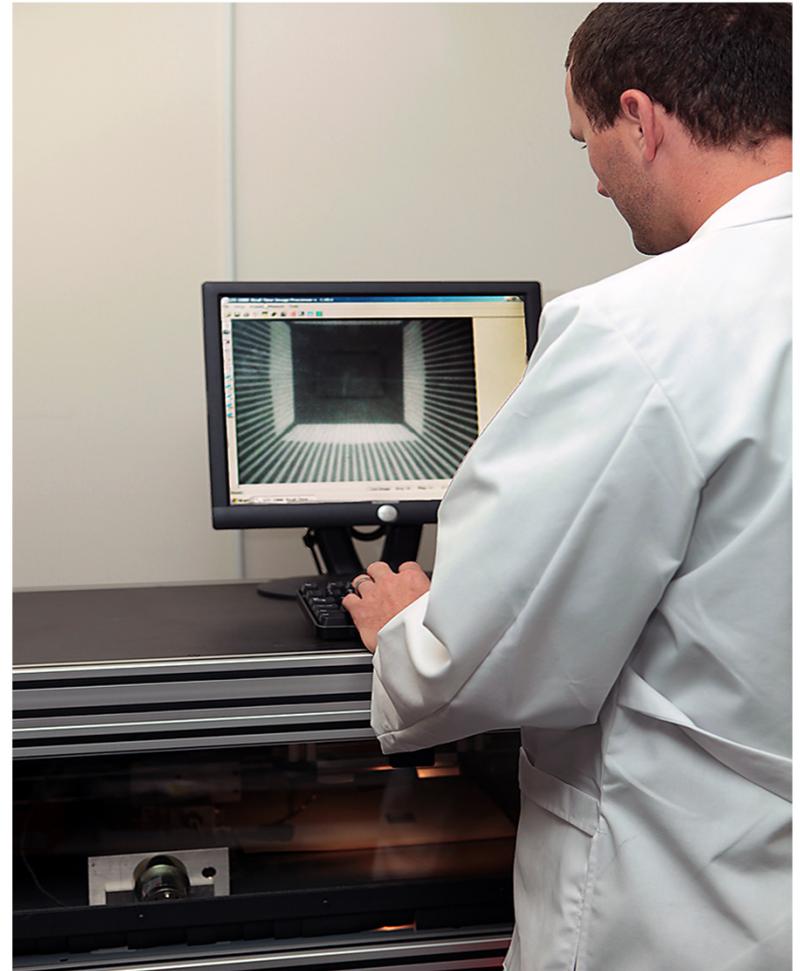
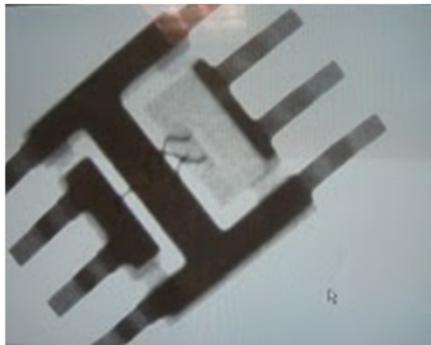
- ▶ Lower life expectancy
- ▶ Curve trace irregularities
- ▶ Out of specification
- ▶ Continuity failures
- ▶ Unknown reliability



[Click here to return to main presentation](#)

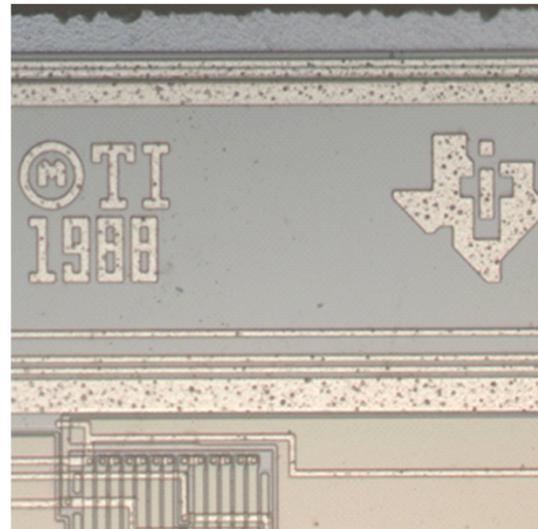
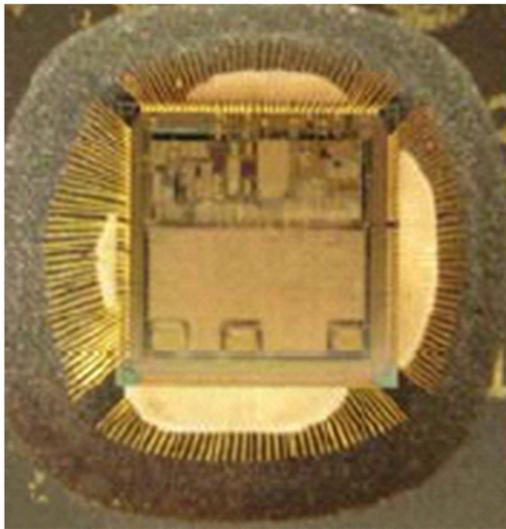
MAJOR STEPS TO DETECT A REPACKAGED PART

X-Ray is effective to look for manufacturing differences in die size, lead frame, bond wire patterns and voids. In some cases there have been no bond wires.



DECAPSULATION

After performing the non destructive tests the part should be opened to verify the die. This does not guarantee all of the parts in the lot are the same, but it is a useful tool and is much cheaper than electrical testing.

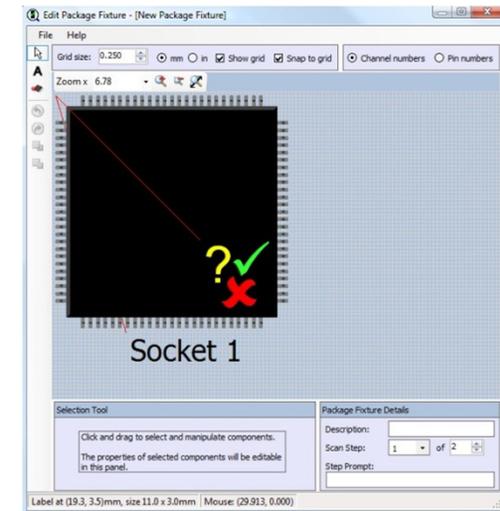
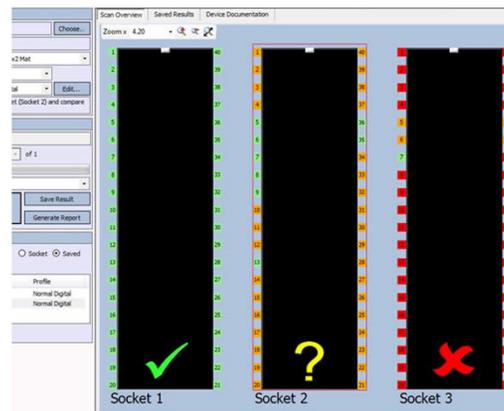


CURVE TRACE

There are limitations to in depth physical analysis;

- ❑ Parts may be re-manufactured or factory rejects in, what appears to be, authentic packaging
- ❑ No conclusive identification information on the die once decapsulated

Therefore some electrical analysis is helpful in determining authenticity. Although full datasheet testing is recommended for high reliability applications, **a curve trace on each lead is a very effective way to begin an electrical examination of the parts.** A "known good" component is required.



ELECTRICAL TESTING

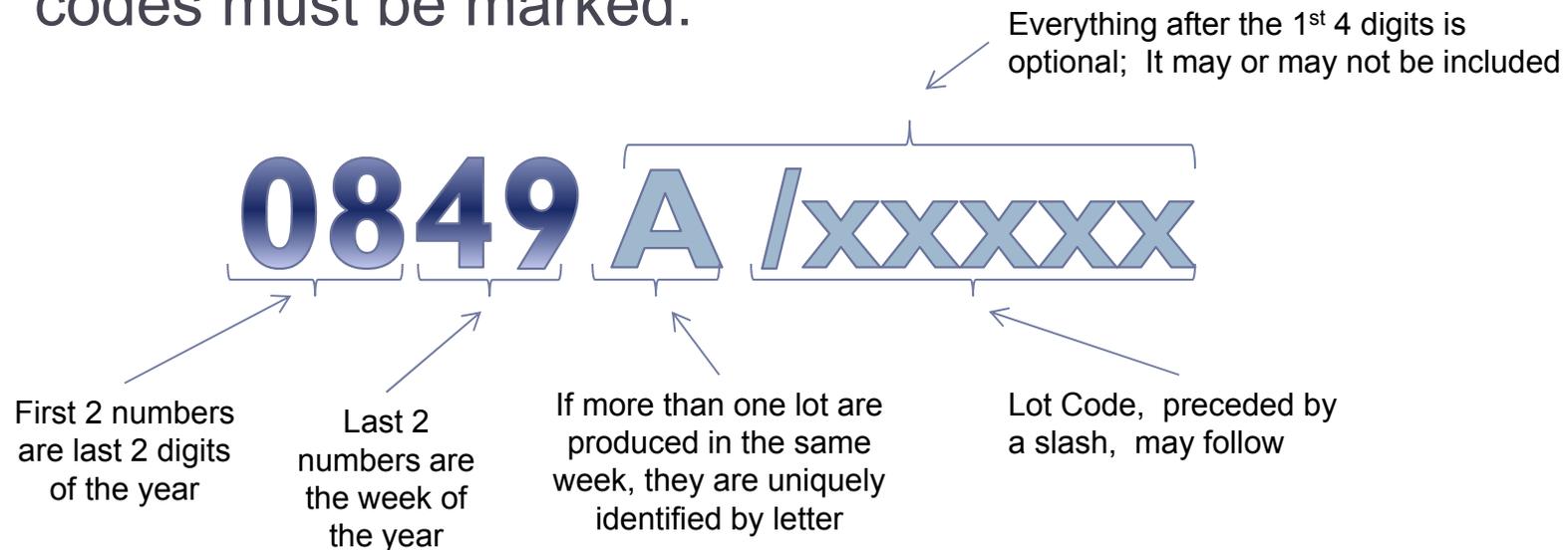
After performing all of the inexpensive tests, if there is any uncertainty, a full specification/data sheet electrical test will provide higher confidence in the suspect parts.

Full data sheet testing can be expensive, but if the product is being utilized in a high reliability application, it is highly recommended.



Risk Mitigation

- ▶ **Manufacturers use:**
 - ▶ Date codes to identify the date of production (sealing) of a part
 - ▶ Lot codes to identify the production lot of a part
- ▶ MIL-PRF-38535 paragraph 3.6.6 specifies how date codes must be marked:





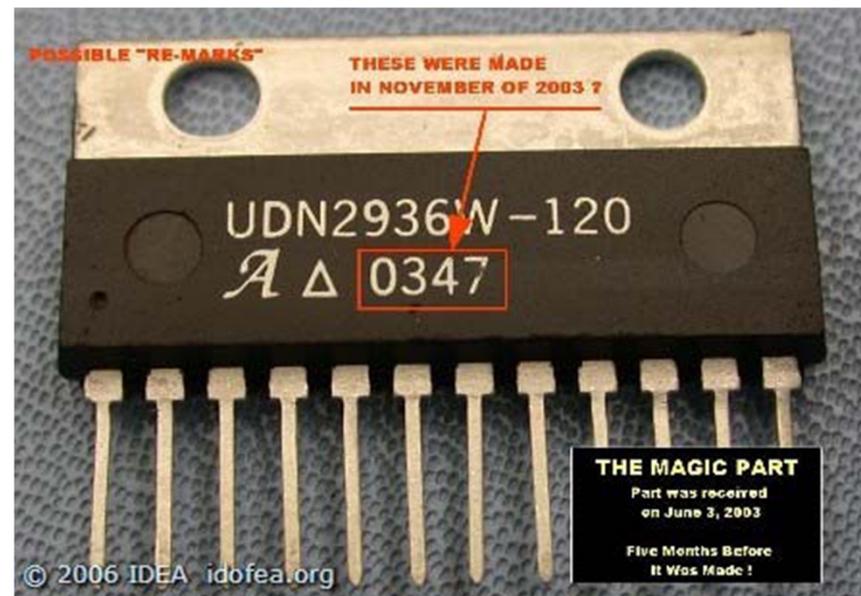
Compliance Verification: Introduction

Counterfeit Parts Avoidance Training

THE MAGIC PART*

- ▶ Date code indicates:
 - ▶ part was made in November of 2003 (47th week of 2003)
 - ▶ Part was received on June 3, 2003

This part was marked with a date code five months into the future compared to the date of receipt!!



[Click here to go back](#)

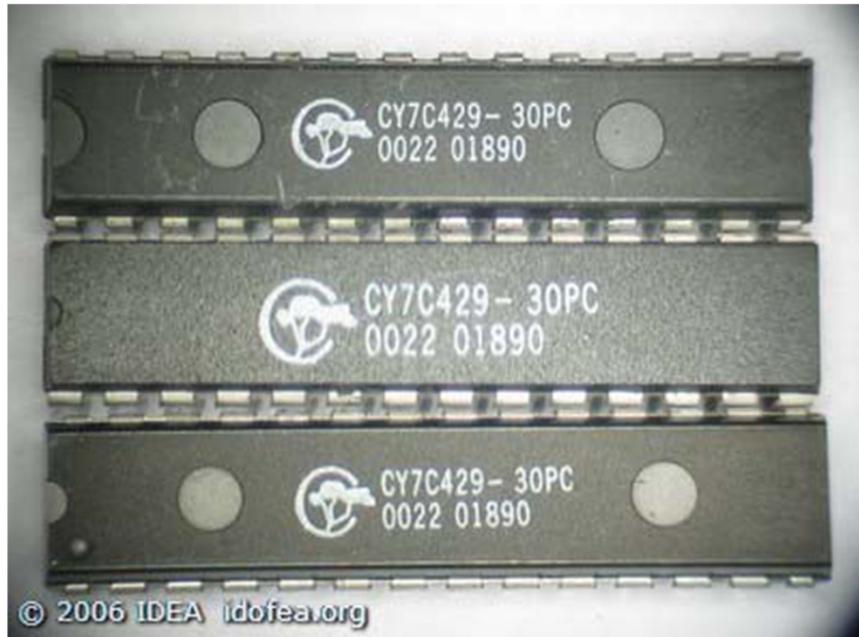
- ▶ * IDEA-STD-1010-A: Acceptability of Electronic Components Distributed in the Open Market



Physical features – product of the mold

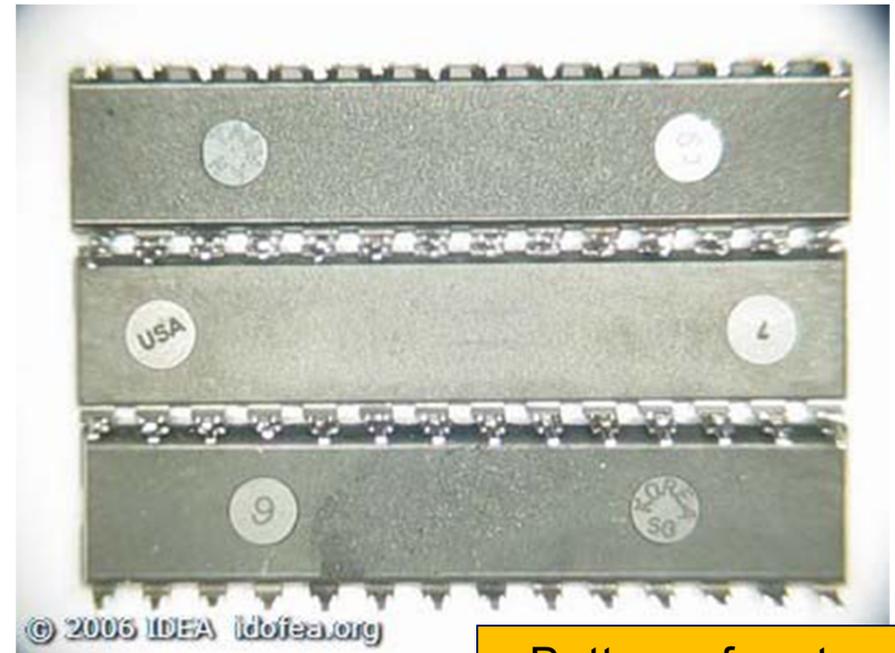
Counterfeit Parts Avoidance Training

Top of parts



- ▶ These parts had the same manufacturer name
- ▶ Same part number

- ▶ Same date code
- ▶ Three different body molds



Bottom of parts

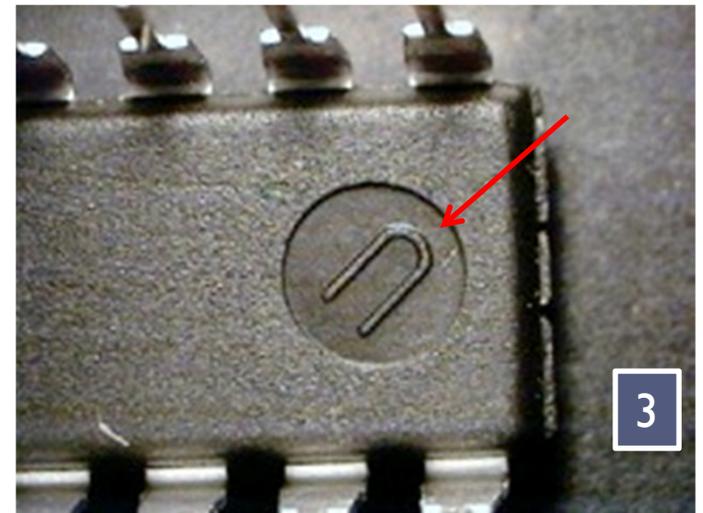
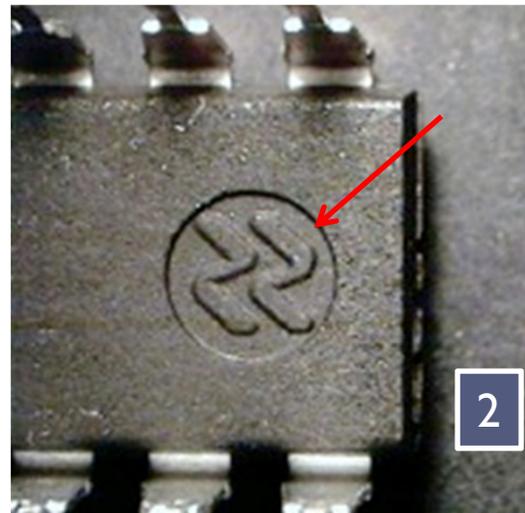
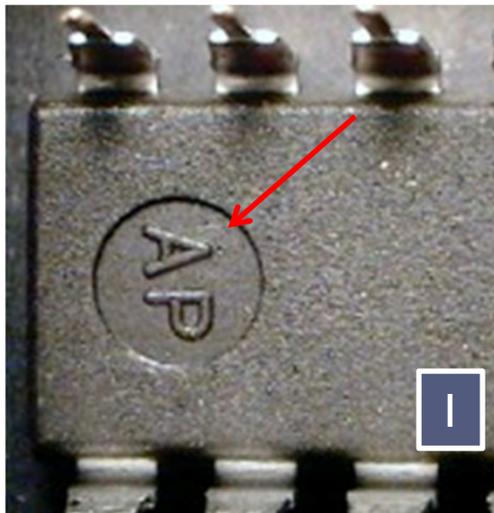
- ▶ * IDEA-STD-1010-A: Acceptability of Electronic Components Distributed in the Open Market



Physical features – product of the mold

Counterfeit Parts Avoidance Training

- ▶ Identical parts on top surface
- ▶ Bottom surface - Indents have completely different markings
- ▶ First part has two letters and second part a symbol
- ▶ Third part - Letter or symbol?



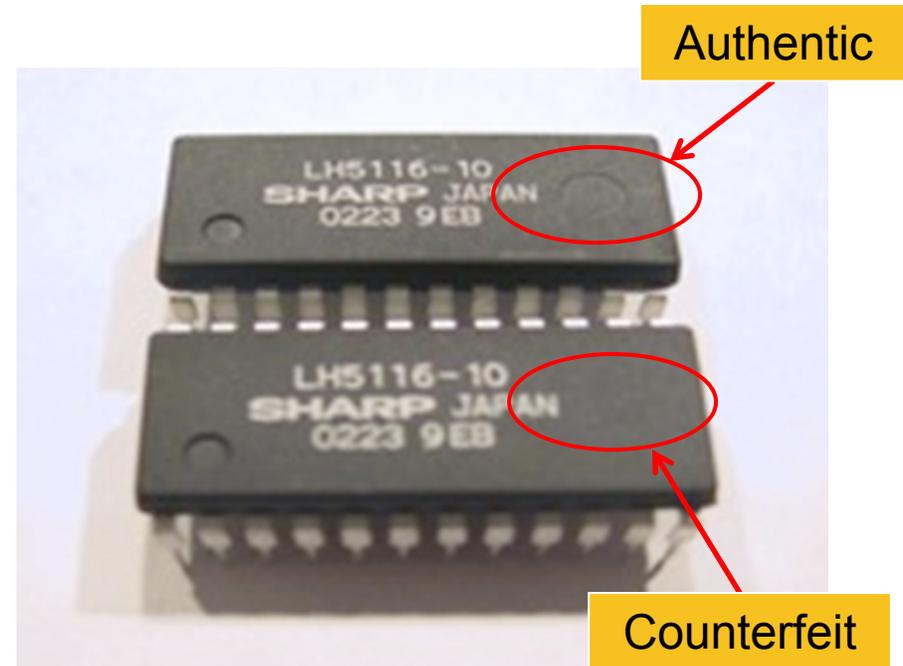
▶ * <http://www.aeri.com/counterfeits.html>



Physical features – product of the mold

Counterfeit Parts Avoidance Training

- ▶ The indents to the lower left look similar
- ▶ Middle right indent is not apparent on the bottom part
- ▶ Counterfeiters sand down the parts to remove original markings
- ▶ They re-surface parts with a process called “blacktopping”
 - ▶ Grayish to black substance
 - ▶ This often fills indents, they should not be filled



[Click here to go back](#)

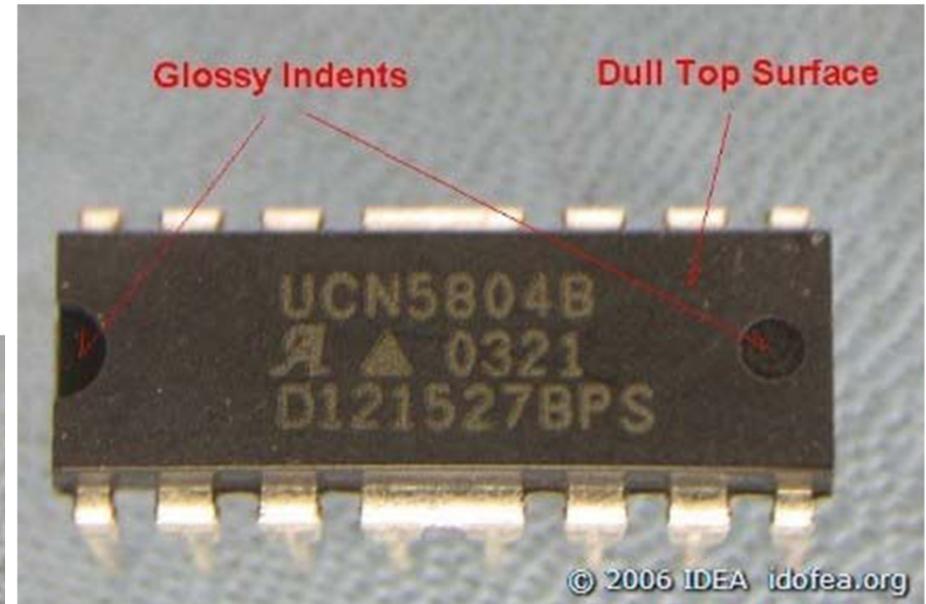
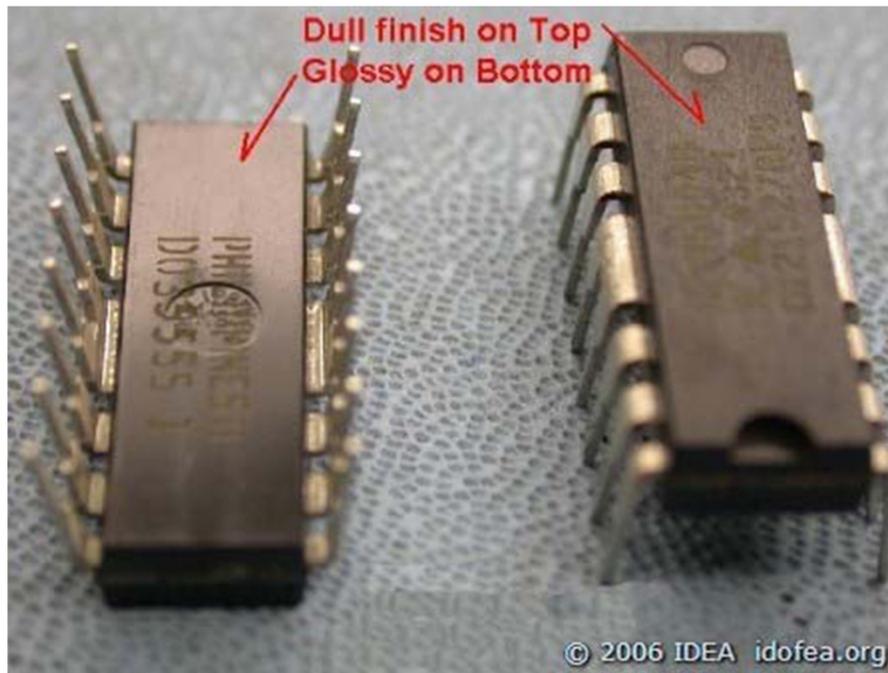
▶ * <http://www.aeri.com/counterfeits.html>



External Visual- Surface Finish

Counterfeit Parts Avoidance Training

- ▶ Part on right has an indications of re-marking
 - ▶ Texture of the body is different than indents



- ▶ Re-marking is indicated by different textures on top side vs. bottom side

- ▶ * IDEA-STD-1010-A: Acceptability of Electronic Components Distributed in the Open Market

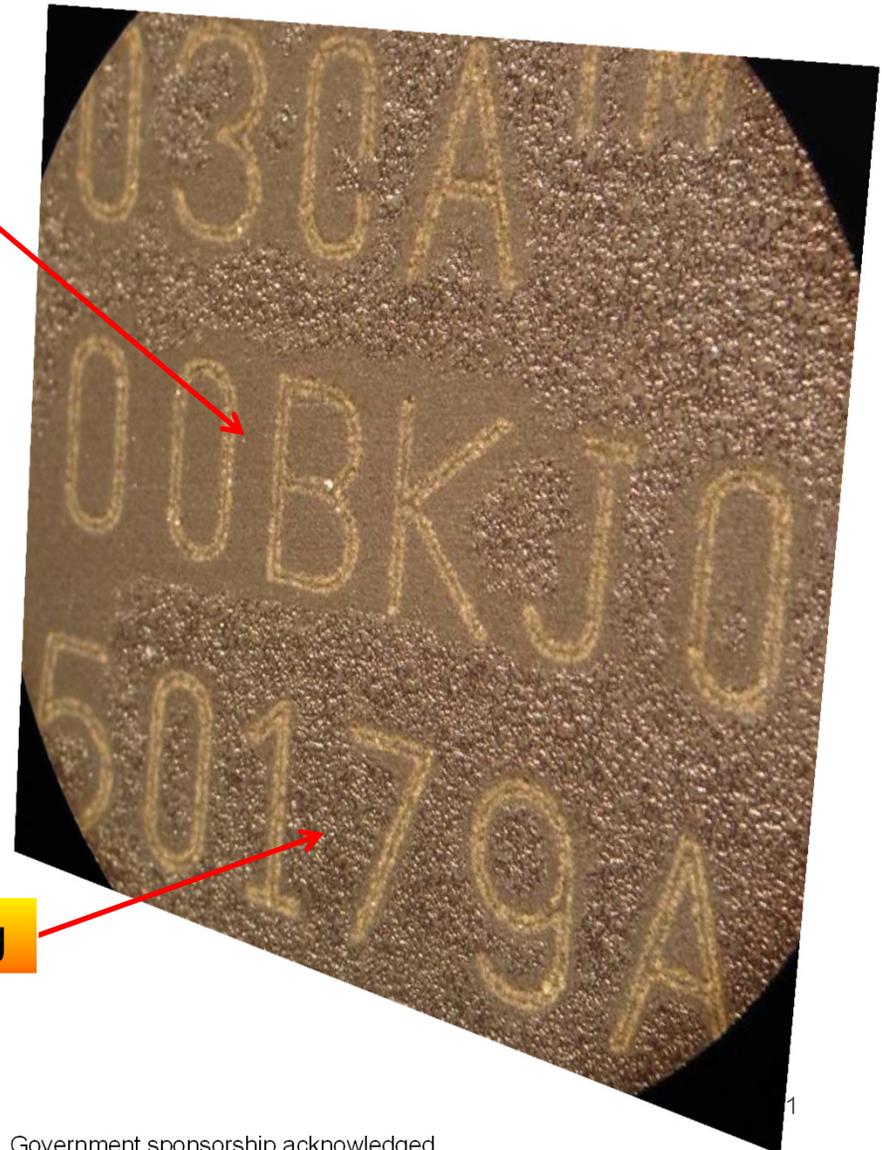


External Visual- Surface Finish

Counterfeit Parts Avoidance Training

“BLACKTOPPING”

- ▶ Non-uniformity in the surface finish due to the blacktopping removal using acetone
- ▶ Blacktopping is becoming increasingly resistant to acetone



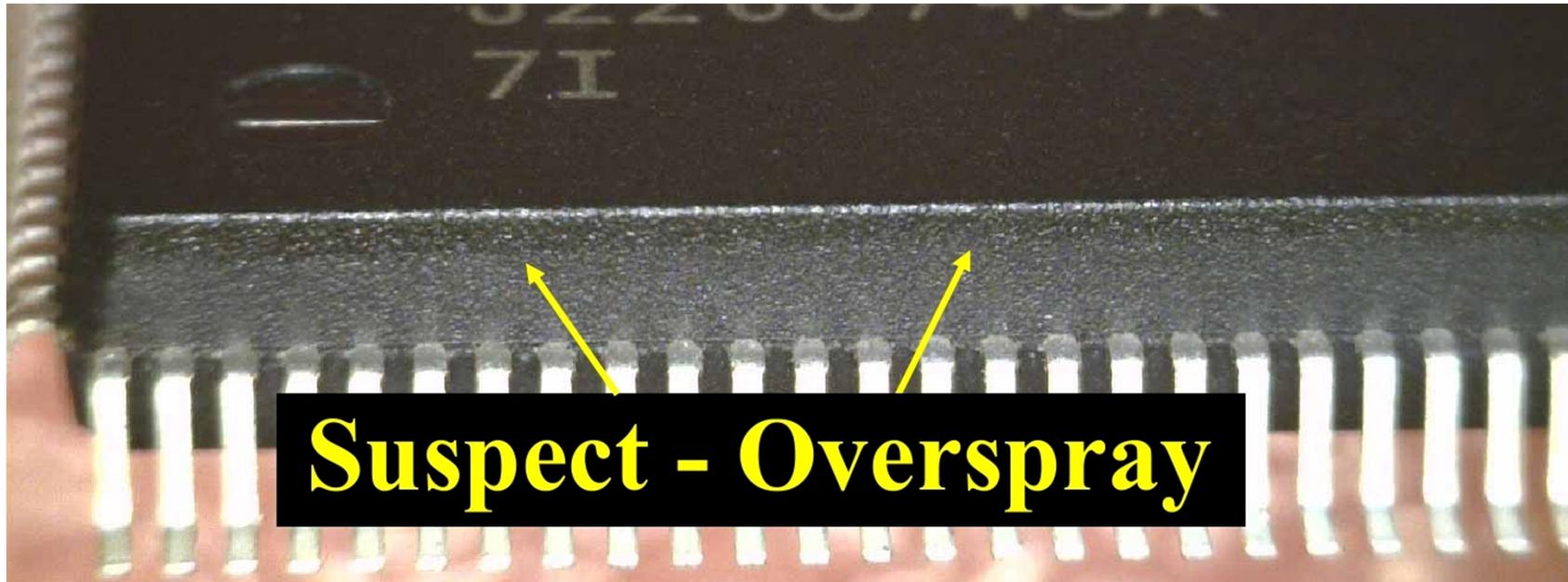
Blacktopping

▶ * <http://www.noleadtime.com/qualitystatement.asp>



External Visual- Surface Finish

Counterfeit Parts Avoidance Training



- ▶ Re-marking is indicated by different textures on top side vs. bottom side
 - ▶ Note: term overspray is used, however blacktop is typically applied with a roller brush

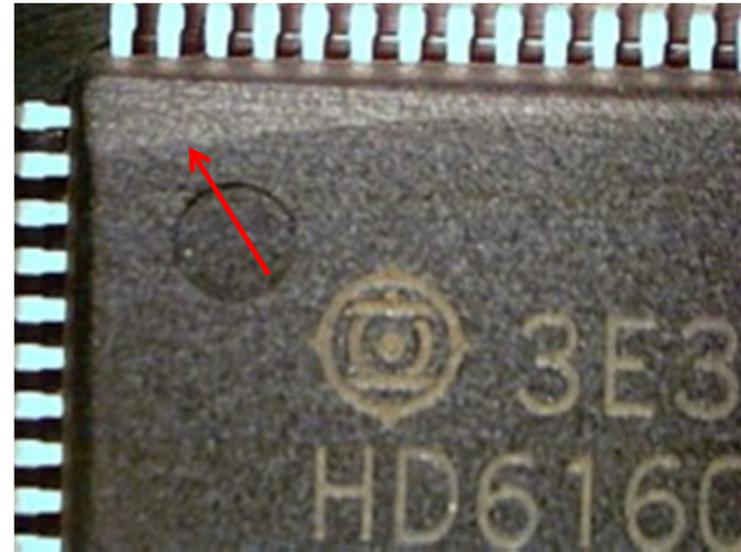
▶ * SMT



External Visual – Surface Finish

Counterfeit Parts Avoidance Training

- ▶ Part on right shows over-sanding



- ▶ Shiny, smooth, but orange peel type finish was not natural looking
- ▶ Scraping the thick-looking blacktop exposed the Altera logo under the Cypress marking

▶ * <http://www.aeri.com/counterfeits.html>



External Visual - Damage

- ▶ Pry marks indicate prior use of part
- ▶ Chips or cracks on a part is a defect condition

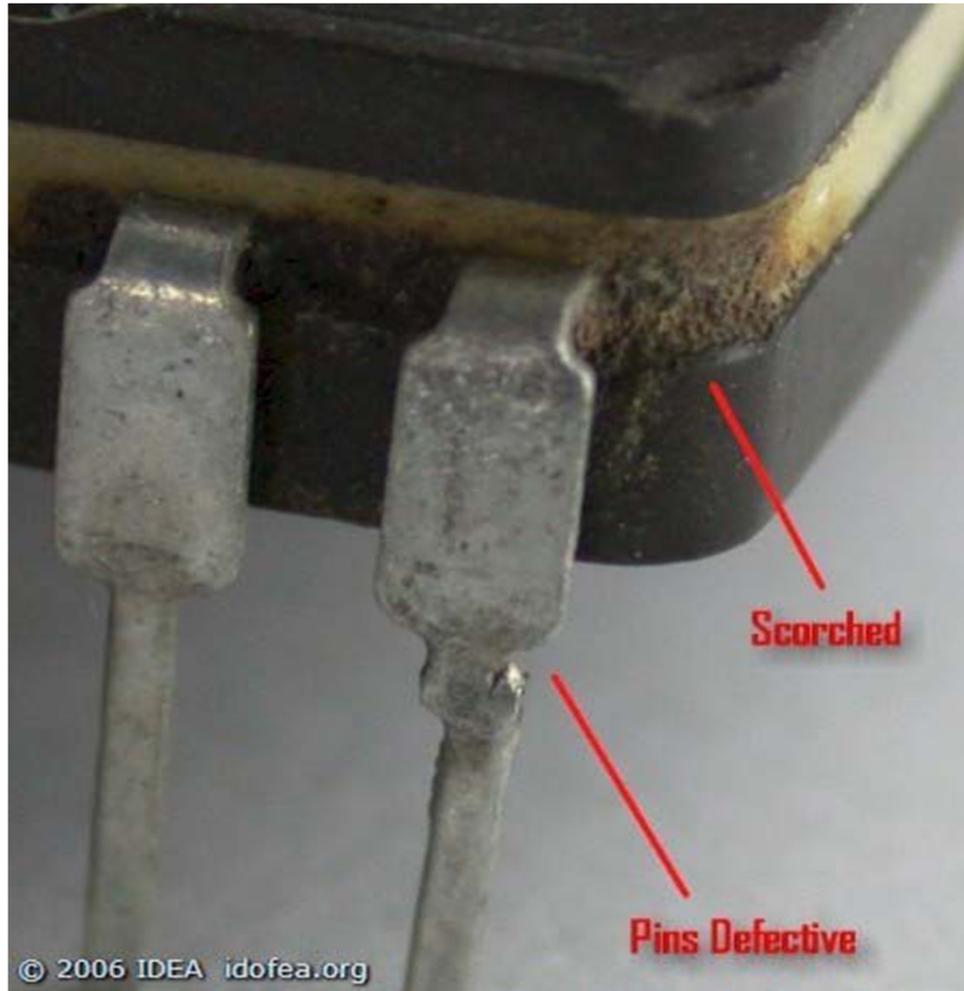


- ▶ * IDEA-STD-1010-A: Acceptability of Electronic Components Distributed in the Open Market



External Visual - Damage

Counterfeit Parts Avoidance Training



[Click here to go back](#)

Damaged leads, scorched body

- ▶ * IDEA-STD-1010-A: Acceptability of Electronic Components Distributed in the Open Market



Part Markings - Permanency

Counterfeit Parts Avoidance Training



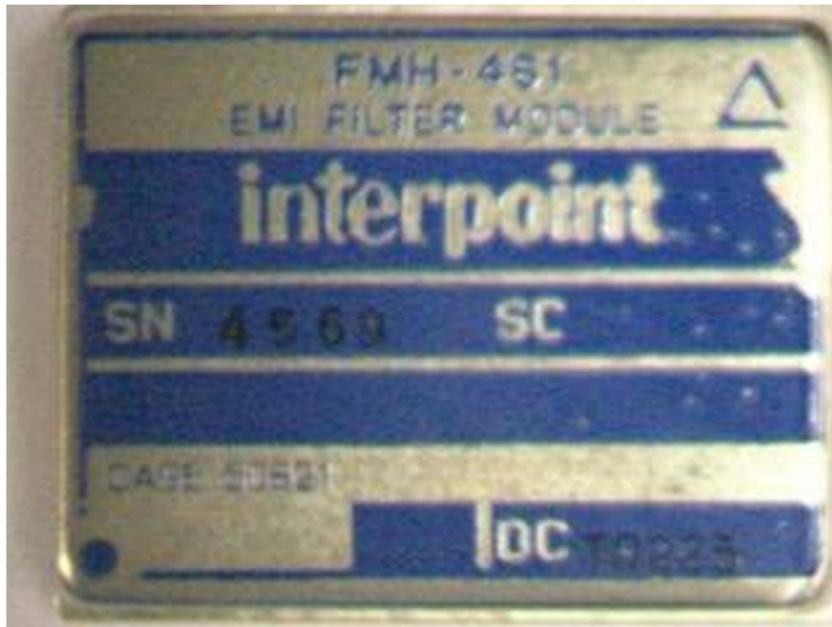
▶ Intel Bottom Markings



Part Markings-Correctness

Counterfeit Parts Avoidance Training

AUTHENTIC



- Properly marked
- Similar vintage and configuration as the fake part

COUNTERFEIT



- Counterfeit logo
- Incorrect fonts & format
- Wrong ink

*Material is from G-12 Counterfeit Parts Risk Mitigation Session, January, 2008 Ron Bradshaw – Interpoint Corporation



Part Markings - Correctness

Counterfeit Parts Avoidance Training

AUTHENTIC

COUNTERFEIT



The bottom markings in black validate configuration, serial number and date code

Bottom markings removed

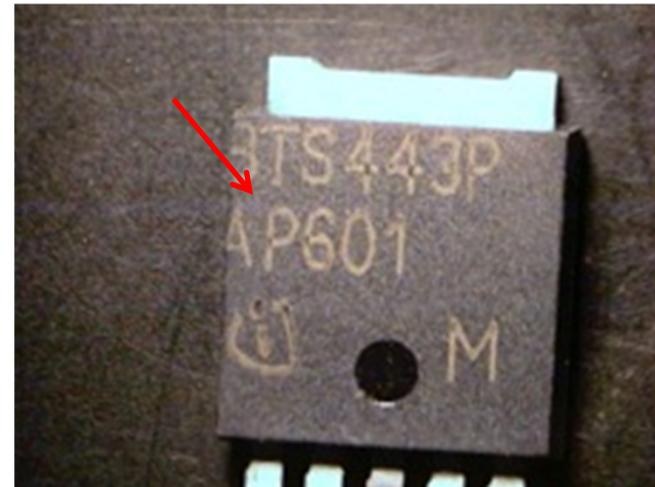
*Material is from G-12 Counterfeit Parts Risk Mitigation Session, January, 2008 Ron Bradshaw – Interpoint Corporation



Part Markings

Counterfeit Parts Avoidance Training

- ▶ OCMs follow quality standards and **major imperfections are uncommon**
 - ▶ P/N will be in a certain location on the part
 - ▶ P/N will not be crooked, misspelled, or out of alignment
 - ▶ Logos very closely monitored, do not vary from part to part
 - ▶ Part markings withstand tough environments and are still legible
- ▶ Part on right has laser burn marks
- ▶ Part on right belonged to a batch that had markings in a slightly different location on each part
- ▶ Markings missed the part on the left hand side
- ▶ * <http://www.aeri.com/counterfeits.html>



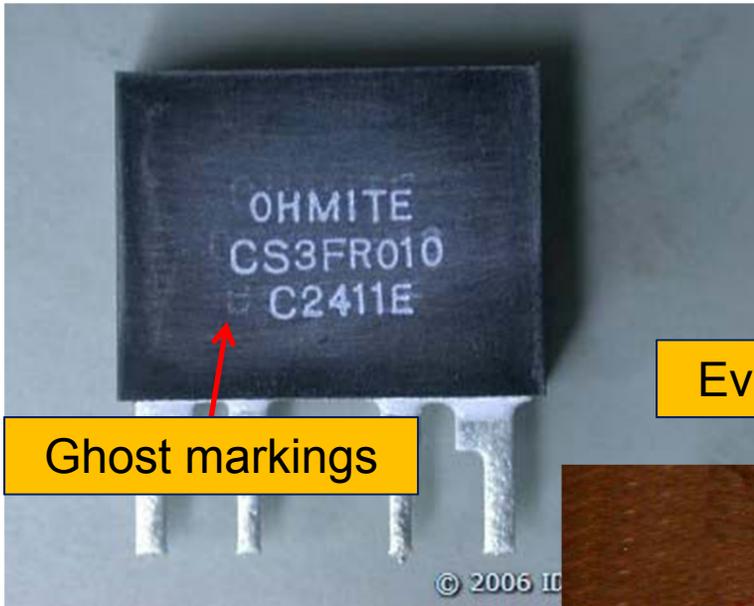
June 2011



Part Markings

Counterfeit Parts Avoidance Training

Phase II



Ghost markings

Evidence of re-marking



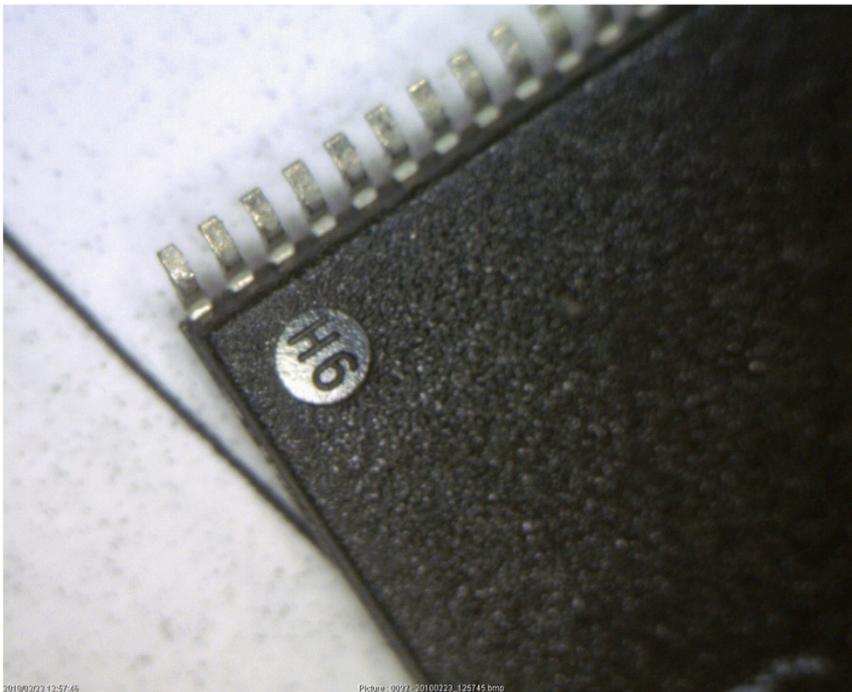
[Click here to go back](#)

- ▶ * IDEA-STD-1010-A: Acceptability of Electronic Components Distributed in the Open Market



Indents - Clean

- Here is what clean indents should look like on good parts
- These are the same indent, two views, two distinct lighting scenarios

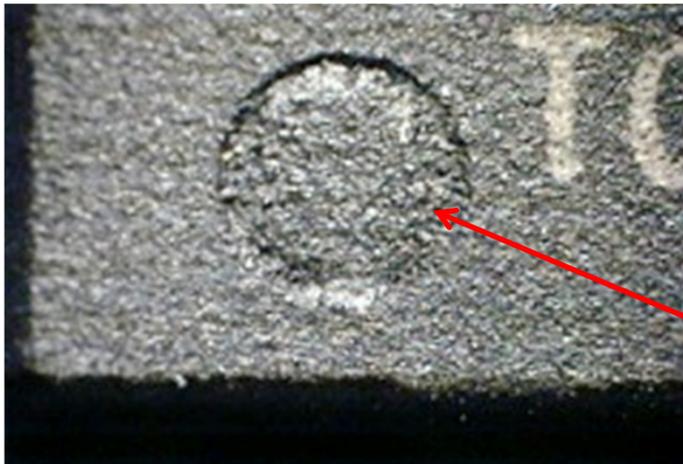
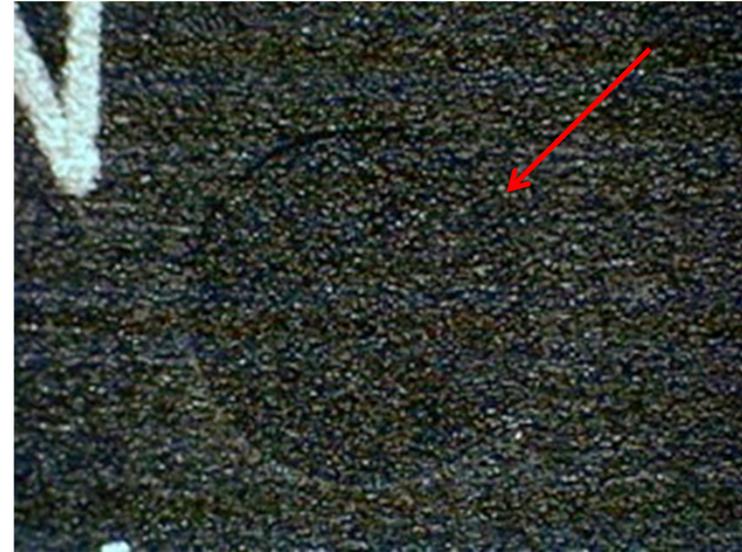




Indents - Clean

Counterfeit Parts Avoidance Training

- ▶ Part on right, indent has been filled with “blacktopping” material
 - ▶ Filled to the edge on one side
- ▶ Indents are never partially made
- ▶ Indents are uniform in depth throughout the circle



- ▶ Original indents are always clean
- ▶ Indent has been filled in with blacktopping material

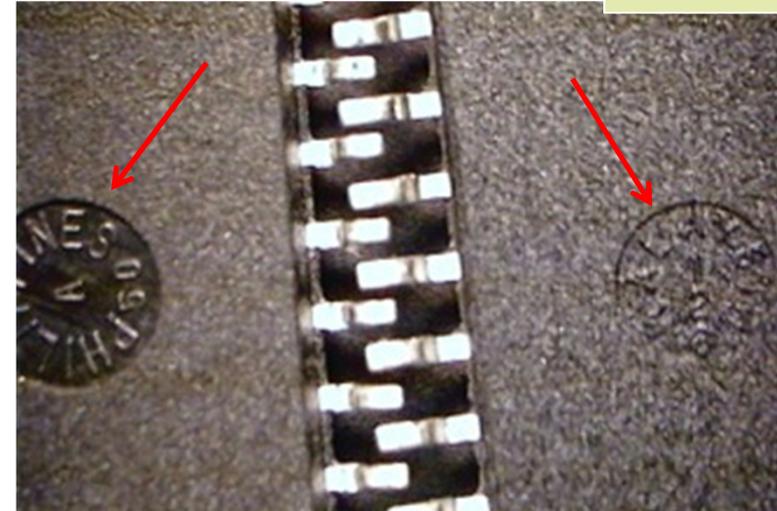
▶ * <http://www.aeri.com/counterfeits.html>



Indent Markings - Clean

Phase II

- ▶ Part on right is marked “MALAYSIA”
 - ▶ Difficult to see marking because of blacktopping
- ▶ Part on left is marked “PHILIPPINES”



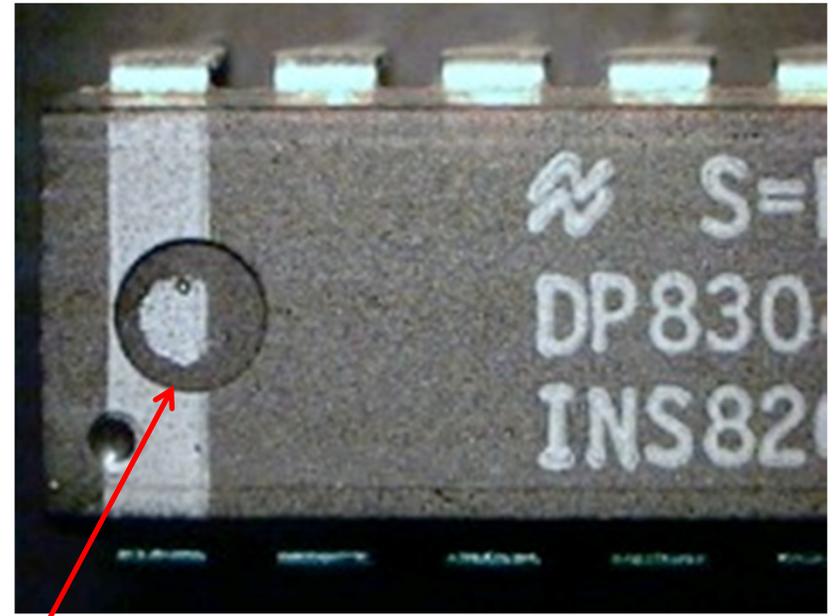
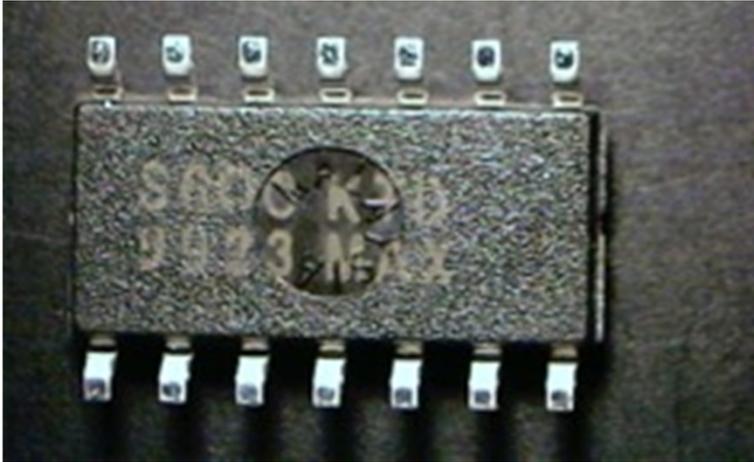
- ▶ Indents are typically smooth and writing within them should not be textured
- ▶ Indent is half-filled with blacktopping material
 - ▶ Letters with texture on them are most likely blacktopped

▶ * <http://www.aeri.com/counterfeits.html>



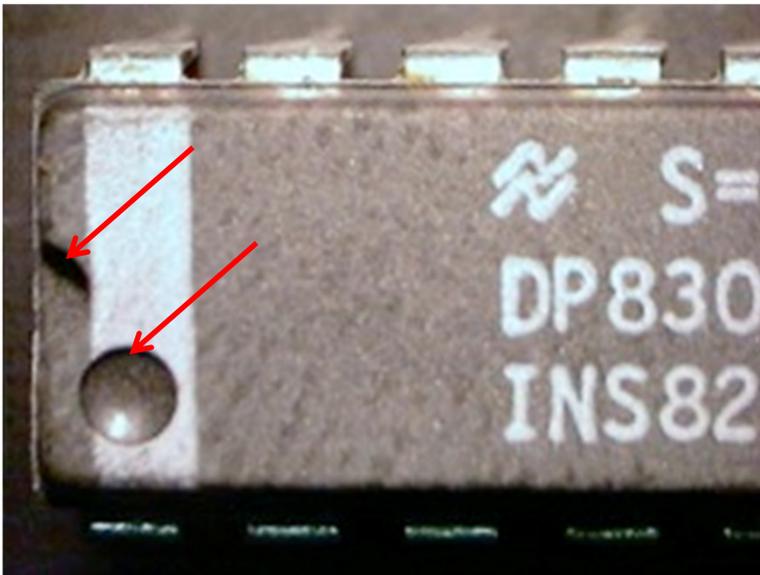
Indents - Clean

Counterfeit Parts Avoidance Training



- ▶ Indent filled in with paint
- ▶ Indents are always clean

[Click here to go back](#)



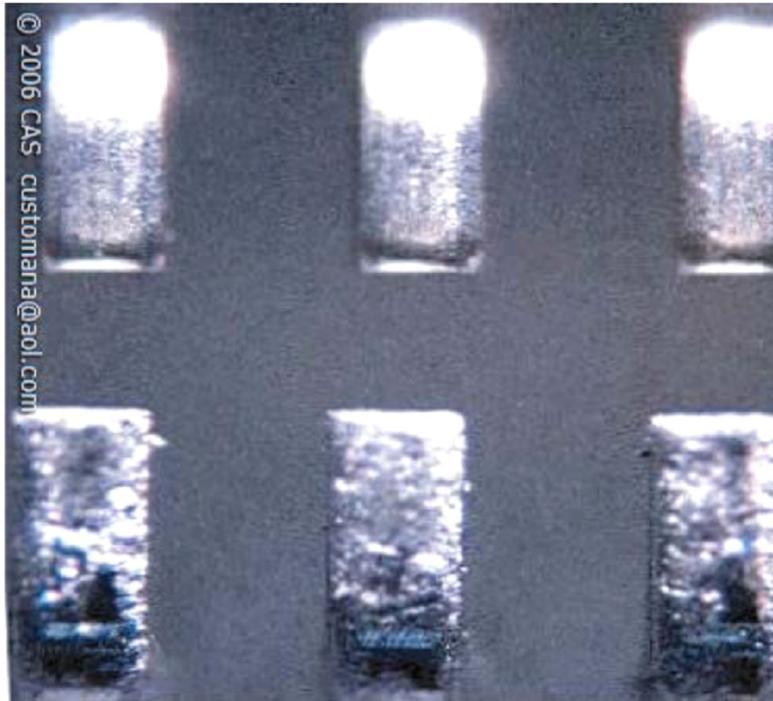
- ▶ The part on the left is from the same lot as the part above
- ▶ One indent is much larger and another is non-existent

▶ * <http://www.aeri.com/counterfeits.html>



Pins/Leads

- ▶ New leads – very uniform, consistent finish, same exact shape



- ▶ Used leads -
rougher texture not
visible to naked eye

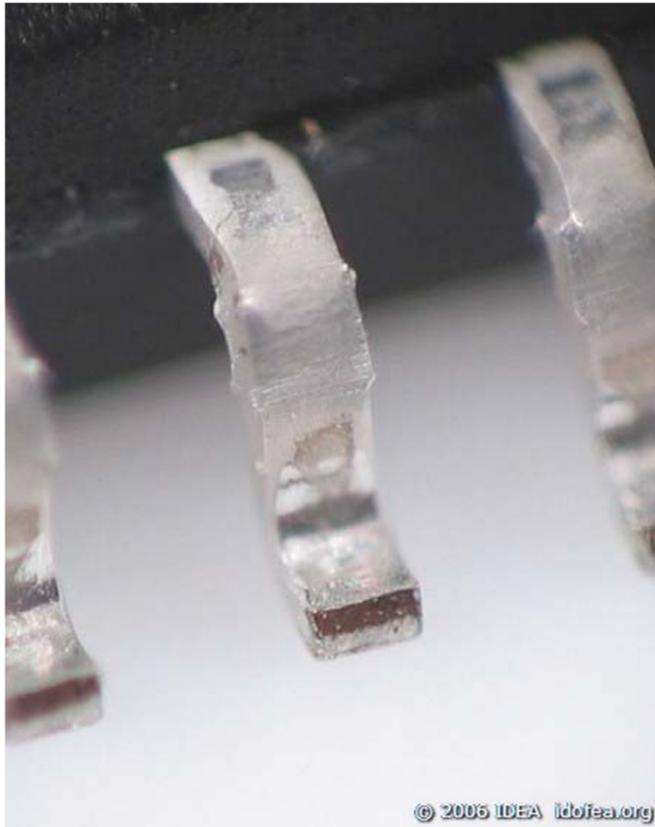
- ▶ * Photo courtesy of Custom Analytical Services, Inc.



Pins/Leads

Counterfeit Parts Avoidance Training

Phase II



Normal tooling marks from
lead formation operation

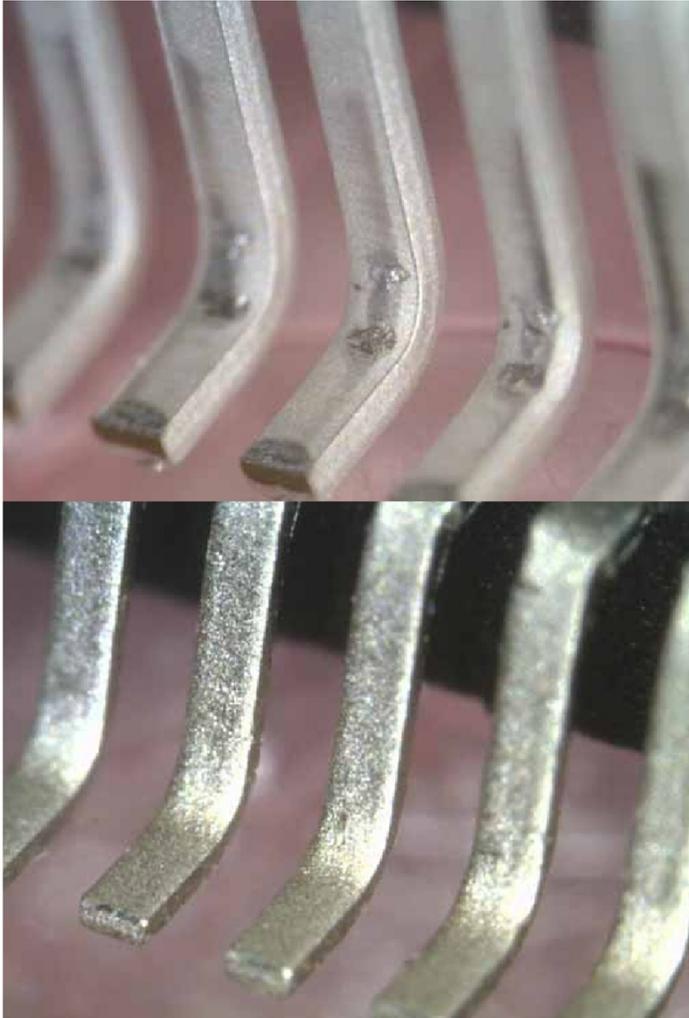
- ▶ * IDEA-STD-1010-A: Acceptability of Electronic Components Distributed in the Open Market

June 2011



Pins/Leads

Counterfeit Parts Avoidance Training



Normal tooling marks from
lead formation operation,
tinned

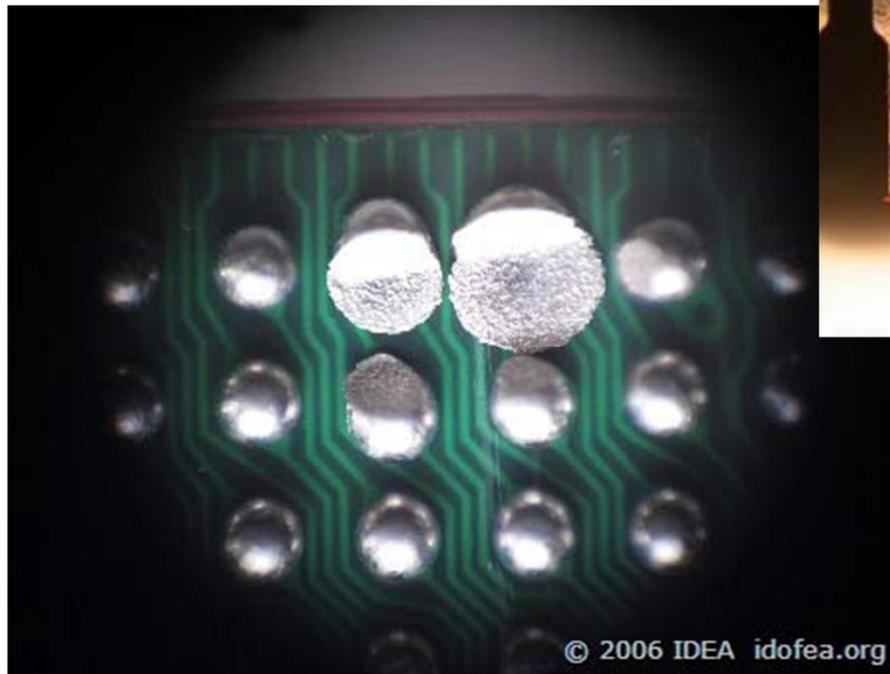
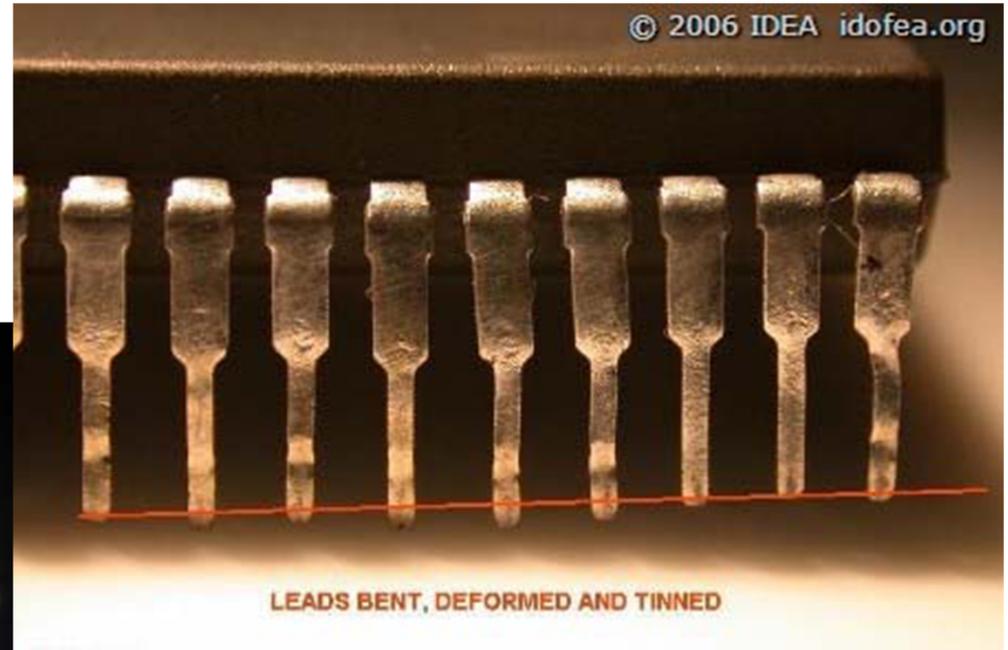
▶ * SMT Corp



Pins/Leads

Counterfeit Parts Avoidance Training

- ▶ Part on right has bent, deformed, and re-tinned leads



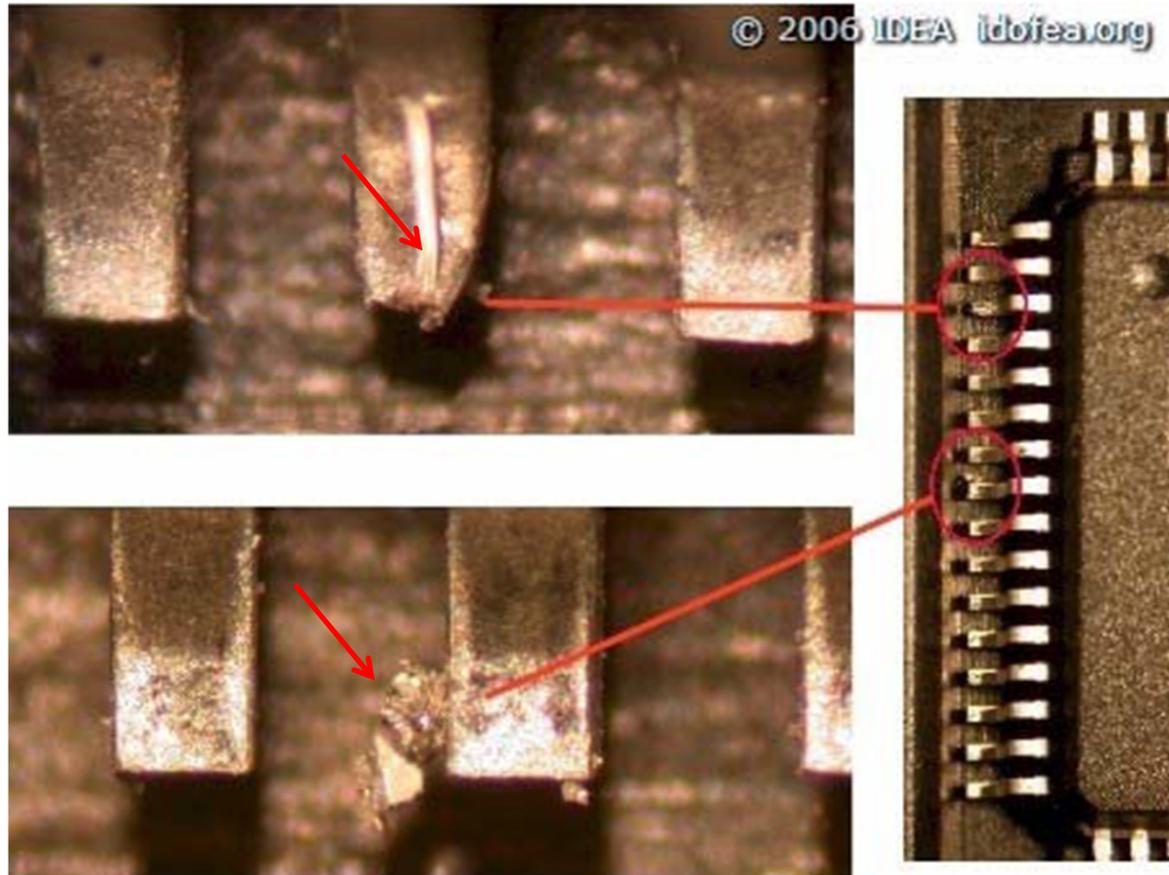
- ▶ Crushed BGA solder spheres

- ▶ * IDEA-STD-1010-A: Acceptability of Electronic Components Distributed in the Open Market



Pins/Leads

- ▶ Solder and debris on leads
- ▶ Damaged leads



[Click here to go back](#)

- ▶ * IDEA-STD-1010-A: Acceptability of Electronic Components Distributed in the Open Market



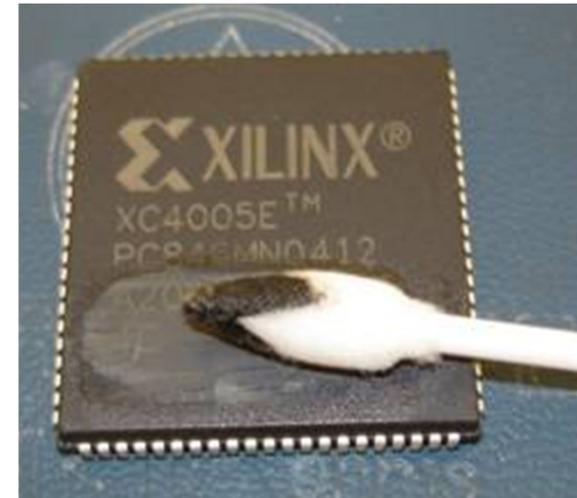
Marking Permanency Test

Counterfeit Parts Avoidance Training

- ▶ **Inspection for Re-marking or Re-surfacing**
 - ▶ Standard “resistance to solvents” test methods can be effective, but more aggressive methods may be necessary to remove coatings applied to disguise sanding marks, and to reveal other indications that the original device marking has been removed.
 - ▶ Scrape surface of part w/a razor blade
 - ▶ Dilute acetone 3:1 with water & swab with Q-Tip
 - ▶ 3:1 mineral spirits/alcohol
 - ▶ Pure/heated acetone
 - ▶ DynaSolve

- ▶ If part has been re-marked, a grayish to black substance might come off

Warning! Will not detect re-packaged CF parts in molded (plastic) packages!



- ▶ *MIL Std 883 Method 2015
- ▶ SAE Aerospace Standard AS5553: Counterfeit Electronic Components; Avoidance, Detection, Mitigation, and Disposition

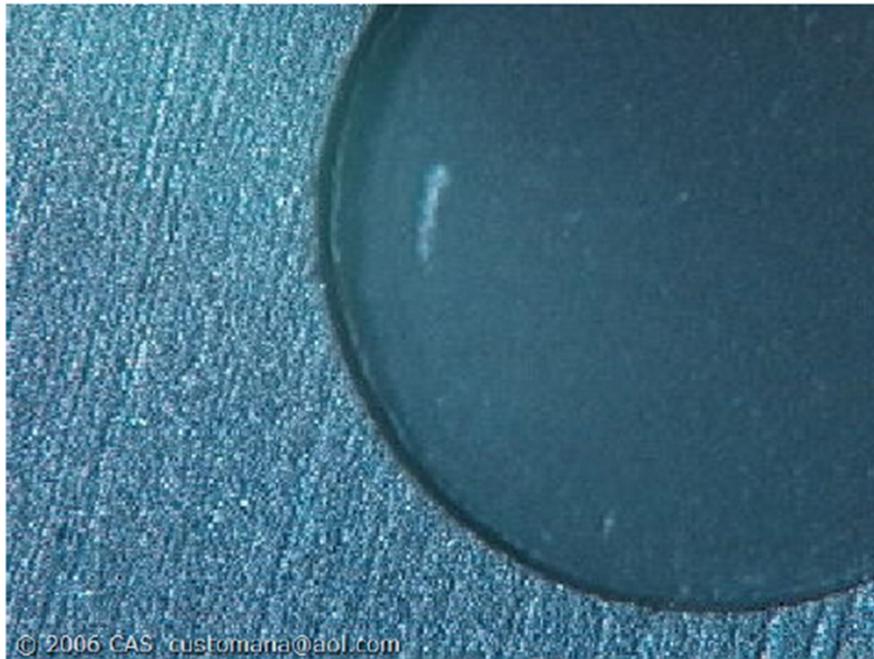
June 2011



Marking Permanency

Counterfeit Parts Avoidance Training

- ▶ Part on right exhibits uniform texture, indent is rough
- ▶ The mold pin cavity (indent) is filled (should be clean and smooth)



- ▶ After surface and mold cavity were chemically cleaned, sanding marks became obvious
- ▶ Clean cavity

- ▶ * IDEA-STD-1010-A: Acceptability of Electronic Components Distributed in the Open Market, Photo Courtesy of Custom Analytical Services, Inc.

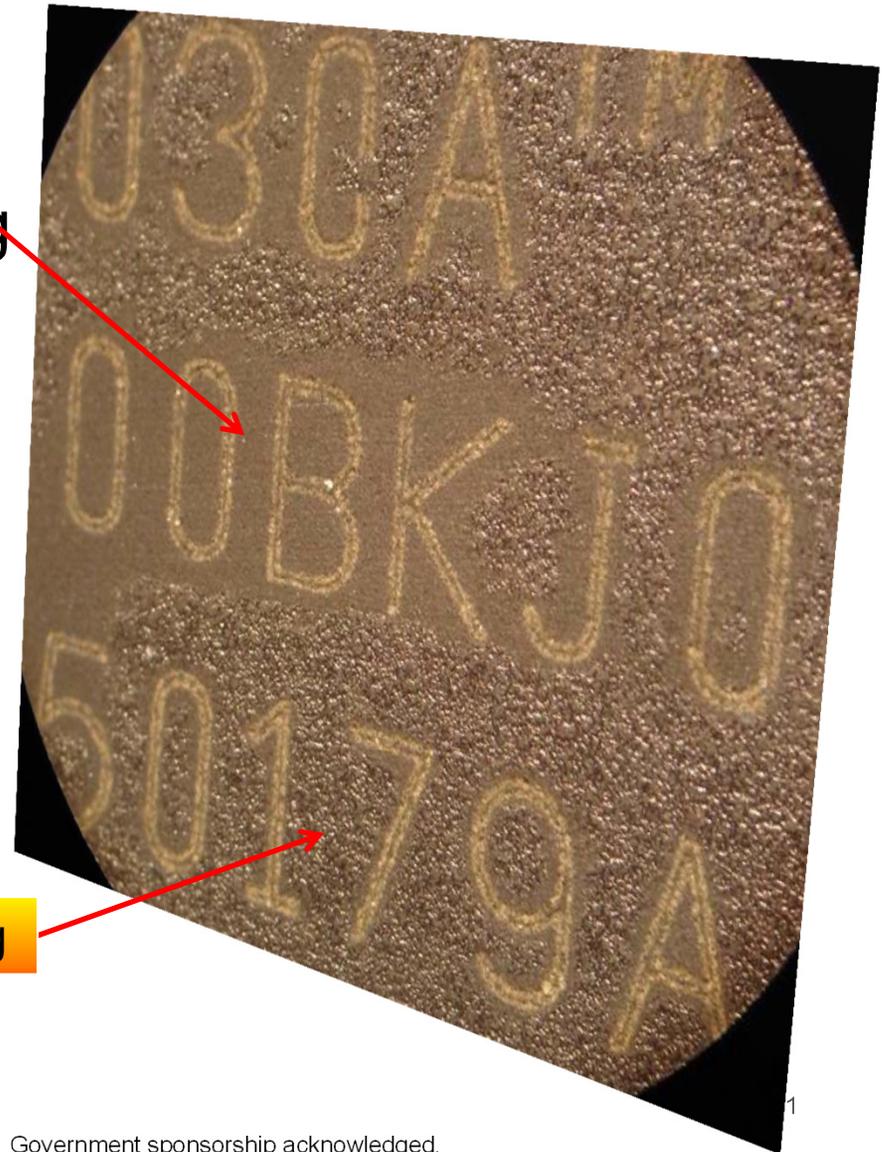
June 2011



Marking Permanency

Counterfeit Parts Avoidance Training

- ▶ Non-uniformity in the surface finish due to the blacktopping removal using acetone



[Click here to go back](#)

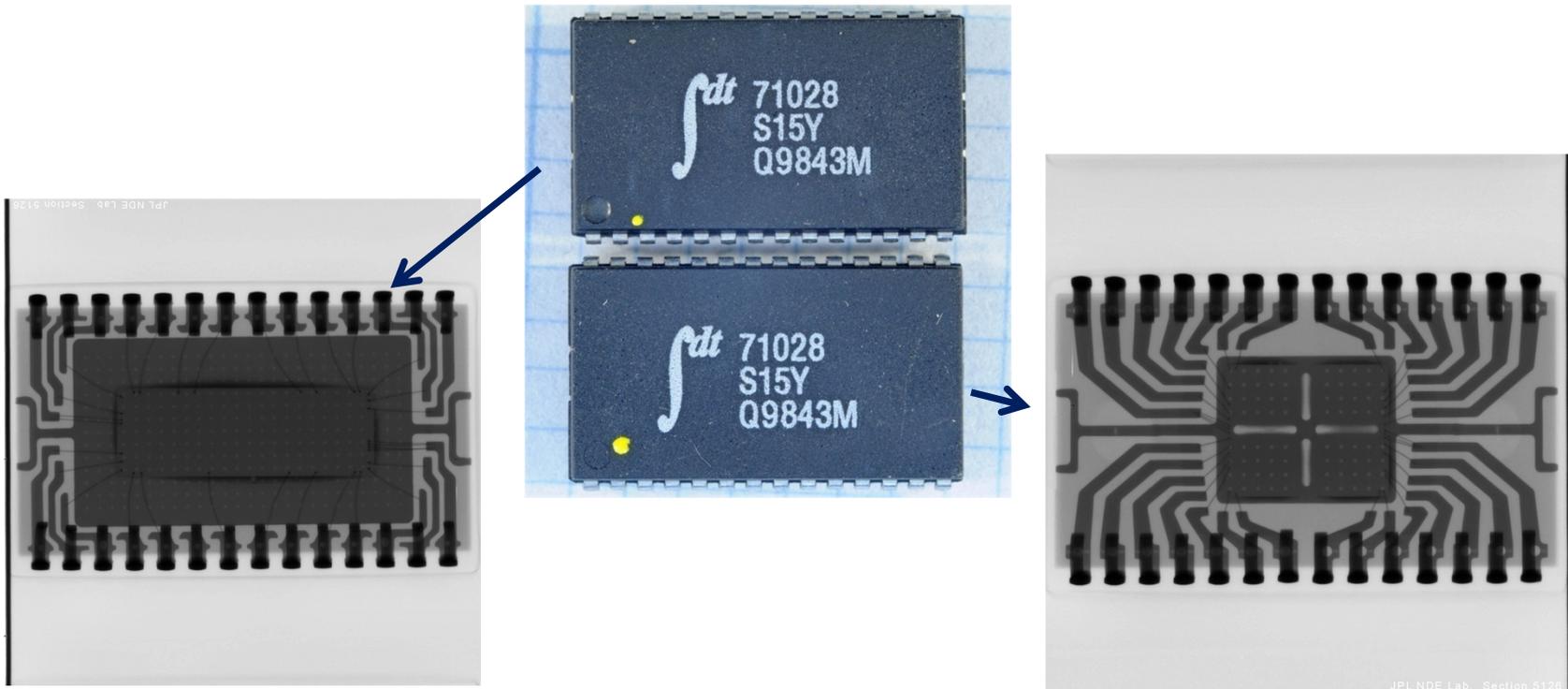
Blacktopping

- ▶ * <http://www.noleadtime.com/qualitystatement.asp>



NDT Methods

- ▶ X-ray
 - ▶ Compare die size, shape, lead frame construction, wire bond gauge and routing

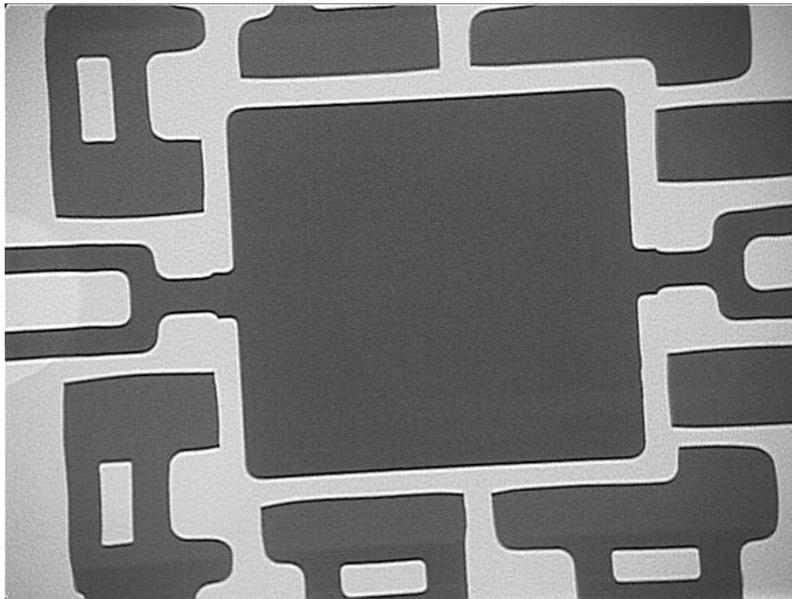




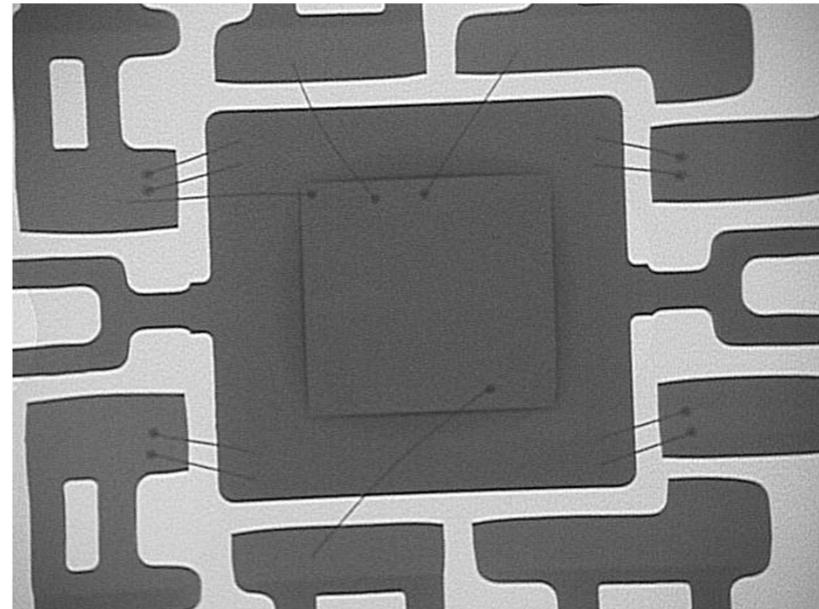
NDT Methods

- ▶ X-ray image of dummy part with no die inside and no wires
- ▶ Outside packaging made to appear authentic

Dummy
Part



Authentic
Part

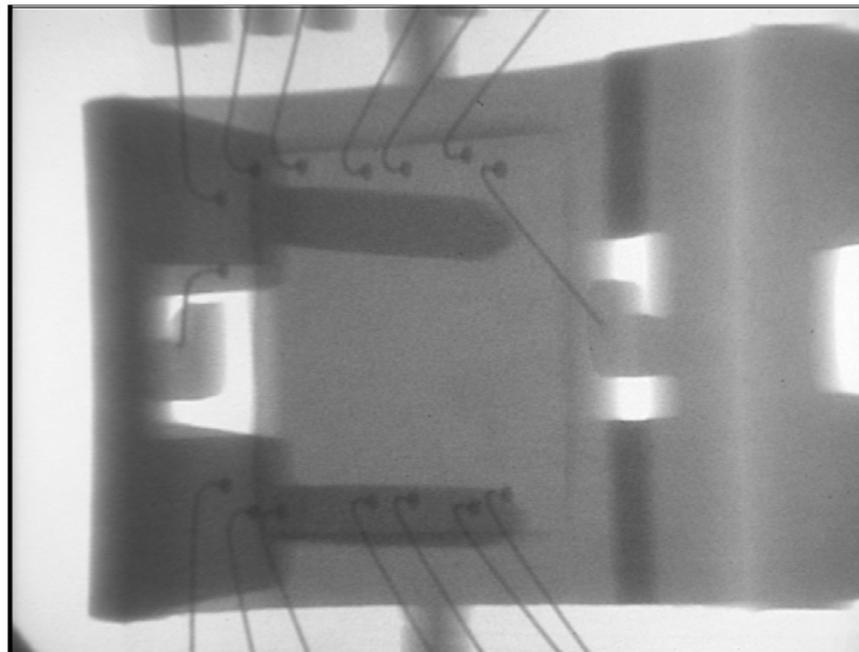


- ▶ * NASA Public Lesson Learned Entry: 1832
- ▶ * <http://www.celnv.de/hv/sn7490.jpg>



NDT Methods

- ▶ **Fein-Focus (Real Time) X-Ray**
 - ▶ Enables inspector to turn part in real time to distinguish perspective of features
 - ▶ Displays image on screen instead of film



[Click here to go back](#)

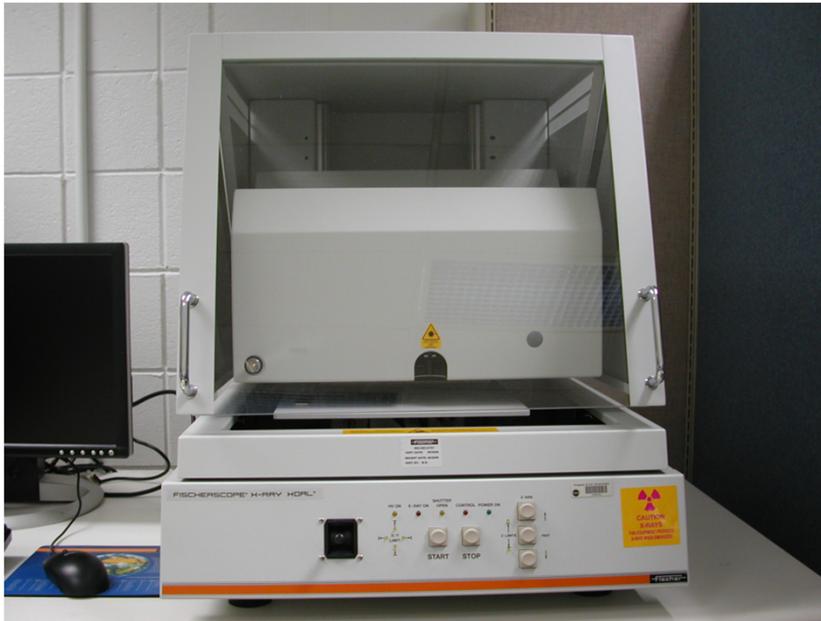


NDT Methods

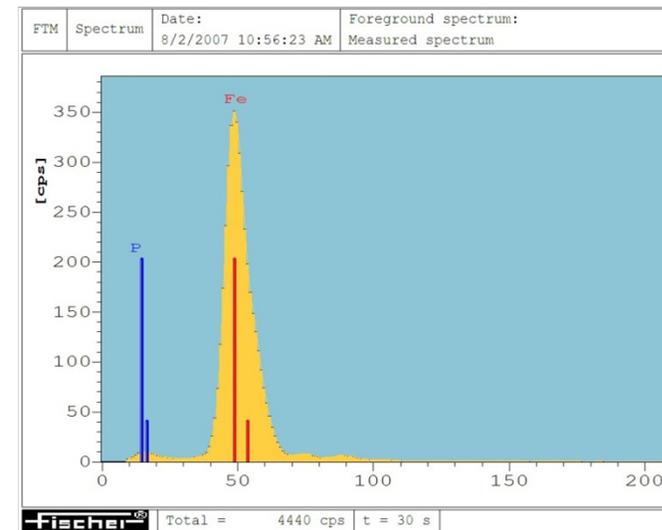
Counterfeit Parts Avoidance Training

▶ X-ray Fluorescence

- ▶ Performed to verify the presence or absence of lead or other materials



XRF Machine in RI



Example Output

[Click here to go back](#)

- ▶ * SAE Aerospace Standard AS5553: Counterfeit Electronic Components; Avoidance, Detection, Mitigation, and Disposition



NDT Methods

▶ C-SAM

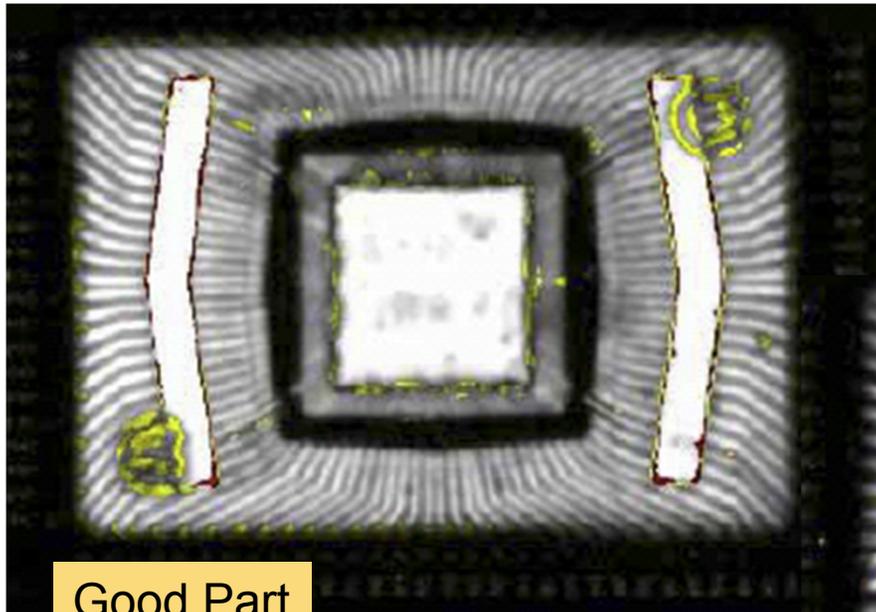
- ▶ Scanning Acoustic Microscopy works by directing focused sound from a transducer at a small point on a target object. Sound hitting the object is either scattered, absorbed, reflected (scattered at 180°) or transmitted (scattered at 0°). It is possible to detect the scattered pulses travelling in a particular direction. A detected pulse informs of the presence of a boundary or object.
- ▶ The Scanning Acoustic Microscope useful in detecting voids, cracks, and delaminations within microelectronic packages.



NDT Methods

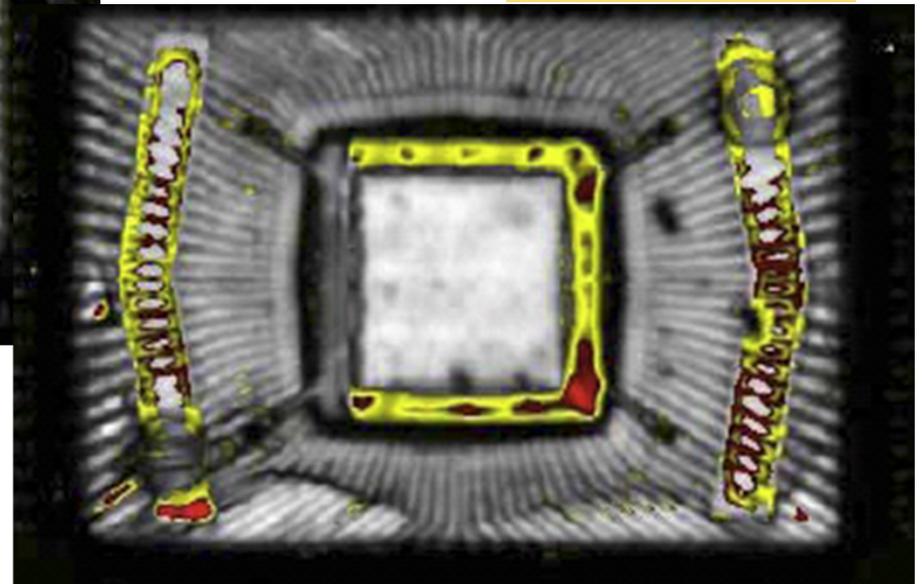
Counterfeit Parts Avoidance Training

▶ C-SAM



Good Part

Damaged Part



[Click here to go back](#)

▶ SMT



NDT Methods*

Counterfeit Parts Avoidance Training

- ▶ **Thermal Cycle Testing**
 - ▶ 125°C to -55°C at least 20 times (MIL-STD-883 Method 1010 Condition B)
 - ▶ Electrically Test and/or Inspect Visually
- ▶ **Burn-In**
 - ▶ Precipitates defects by exposing parts to accelerated stress levels (e.g. temperature and voltage) (See Appendix for details)
- ▶ **Electrical Testing** [..\Proposals\Counterfeit Part Detection.pptx](#)
 - ▶ Continuity
 - ▶ Functional
 - ▶ Parametric
 - ▶ ORAFEC

[*Click here to go back*](#)

- ▶ * SAE Aerospace Standard AS5553: Counterfeit Electronic Components; Avoidance, Detection, Mitigation, and Disposition



Additional Terms and Definitions

Counterfeit Parts Avoidance Training

- ▶ **DISPOSITION:** Decisions made by authorized representatives within an organization concerning future treatment of nonconforming material. Examples of dispositions are to scrap, use-as-is (normally accompanied by an approved variance/waiver), retest, rework, repair, or return-to-supplier.
- ▶ **ERAI:** A privately held global trade association that monitors, investigates, reports, and mediates issues affecting the global supply chain of electronics, including supply of counterfeit and substandard parts. <http://erai.com>
- ▶ **IDEA:** Independent Distributors of Electronics Association, a non-profit trade association representing independent distributors that have formally committed to adhere to prescribed quality and ethical standards. The stated purpose of IDEA is to promote the independent distribution industry through media advocacy; to improve the quality of products and services through a quality certification program, educational seminars and conferences; and to promote the study, development, and implementation of techniques and methods to improve the business of independent distributors. <http://idofea.org>

- ▶ * SAE Aerospace Standard AS5553: Counterfeit Electronic Components; Avoidance, Detection, Mitigation, and Disposition