Trusted Suppliers

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Trusted Suppliers

- Trusted based on what?

  - Meeting delivery time, from stock or have to find them

  - Low prices, have adequate liability insurance?

  - History and past performance – why will it continue?

  - **Effective verification practices to detect counterfeits?**

- How can any supplier be trusted without?

  - Verification of components authentic characteristics

  - Unequivocal traceability to original sale by OCM/AD

- Without verification of authenticity by the seller they cannot be A TRUSTED SUPPLIER

- Lets explore this topic:

  - I will discuss my views of "Trusted Supplier"

  - Present some examples of hard to detect counterfeits

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First, lets get acronyms identified

- **AD** - Distributor Authorized by OCM to sell their components
- **ARM** – Authorized Re-manufacturer after OCM obsoletes component production.
- **CF –** Counterfeit component
- **CM** – Contract manufacturer
- **OCM** - Original Component Manufacturer
- **OEM** - Original equipment manufacturer that uses components, includes the CM.
- **ID** - Independent Distributor, not authorized by OCM, from stock or reseller.

Each of these have a responsibility for avoiding counterfeit components.

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Supply Chain Contributors to Counterfeits

- OCMs
  - Not enough control over rejects, scrap, test samples, illegal plant production, etc.
  - Failure to assist in authentication of obsolete Gray Market components.
  - Remarking or downgrading without C of C of action
- OCMs & ADs allowing return of customer stock with little verification of authenticity.
- ADs that purchase from IDs without verifying authenticity.

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Supply Chain Contributions (cont.)

- OEMs/CMs
  - Failure to design out obsolete components
  - Poor order planning & purchasing lead time
  - Exercise little control of ID suppliers
  - Looking for low prices

- Independent Distributors (ID)
  - Inadequate verification
  - Personnel need better training
  - Lack of information & data for authentication
  - Think previously "Trusted Suppliers" continue to be adequate
  - Verification of authenticity must be a mandatory practice

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- Customer should clearly specify they need, "New and unused OCM components"

- Should be ordered from OCM or their AD when available.

- What are counterfeit components?
    - Components reclaimed from scrap electronics and sold as new.
    - Alteration of OCMs markings - not by OCM.
    - Fake components - no similarity, no die, etc.
    - Newly manufactured components using reclaimed die and marked in violation of OCM IP.

- Obsolete components: eventually new, unused components will no longer exist or can be found.

- Customer should accept realism and redesign or accept refurbished components

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How to detect reclaimed or remarked components:

- Packaging & shipping containers not OCM typical is warning sign
- Thorough inspection of leads for signs of prior use
- Inspection of markings and the package
  - Non-typical OCM markings or logo
  - Signs of blacktopping or over-coating
  - Mechanical and solvent detection of marking alteration
  - X-ray to check for consistent internal construction per date code.
- Select suspicious and random samples for destructive testing – XRF for lead material and decap to verify die markings and design.
- Electrical test to confirm performance - (may not detect reclaims)
- Thorough component investigation for tell tale signs of not authentic

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Verification based upon RISK LEVEL of supplier

- All require some level of verification based upon risk level

- **OCM is lowest risk** -- still check for human errors and quality issues - used to be called incoming inspection

- **AD's have a little more risk** -- some ADs are purchasing from IDs for delivery time & low price. Search for signs of returns, when found investigate as if from ID.

- **ID - they are high risk** - require a comprehensive verification program

- The huge number of counterfeit components negate previously **trusted suppliers (good history)** unless they have rigorous detection program.

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The NDAA 2012 Sec. 818

- The DoD Regulations to implement the Congressional mandated requirements are expected to be very rigorous.
- They will certainly mandate all Mil OEMs take actions to detect & avoid counterfeits and be responsible for any escapes.
- The current status of obsolete components supply chain will mandate comprehensive inspection and testing of components from open market – includes military spec and COTS components
- The fines and penalties will flow to OEM/CMs and from there to the component sellers, and many may not accept the business.
- Now what?
- Supplier's carelessness and incompetence will encounter penalties.
- Most likely allowance will be made for difficult (impossible) escapes.

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What is the CCAP-101 Certified Program?

- A Program devised by the staff of Components Technology Institute, Inc. to detect and avoid counterfeit components.
- The staff has more than 100 years experience in electronic components engineering, reliability controls, quality, supply chain practices at:
  - NASA & space industry
  - Military OEMs
  - Component manufacturers
  - Contract manufacturers
  - Analysis labs
- CTI is an independent engineering and consulting company not in the components sales business.

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CCAP-101 Certified ™© Goals

- Stop or greatly curtail the delivery of counterfeit components

- Reduce the OEM/CM risk of purchasing counterfeits through Certified Independent Distributors

- Mandates minimum tests and inspections

- Purchase requirements to remove the profit motivation - no payment, no return of components, legal disposal.

- Places responsibility for counterfeit avoidance on the IDs

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To Achieve Certification

- ID must submit an Application & agree to conditions
- Formally document Avoidance Procedures per CCAP-101
- Submit Procedures to CTI for approval
- CTI performs an on site audit of ID procedures and capability
- After any audit issues are resolved - Certification is granted
- Effective for 12 months & renewable
- Delivery of counterfeits results in suspension or termination
- All components delivered as certified to CCAP-101 TM CR must pass these procedures
- Customers and IDs are not allowed to alter or waive these procedures
- Customers may add requirements (electrical test, solderability, re-balling BGAs) after authenticity is established
- ID is responsible for all claims made by customer

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Elements of CCAP-101 Certification ™ ©

1. Mandatory purchasing conditions by ID

2. Require specific inspection capability

3. Comprehensive and documented procedures - CCAP-101

4. Inspection of shipping and packaging documentation

5. Intense visual inspection, 100% or sampling, 50pcs/1000

6. Test for remarking alteration – min 3pcs/lot

7. X-ray inspection - Large sample – Look for mixed production

8. Use of competent test labs

9. XRF leads and Decap for die inspection - 3pcs per lot/sublot

10. Electrical testing - DC, AC, temp and product specific tests - 100% or sample lots/sublots over 30 pcs then 30/1000.

11. E-Documentation of data with 5 yr. retention required

    For details see: **http://cti-us.com/CCAP.htm**

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Components Inspection

- **All markings require detail inspection, front & back**
  - Correct part number, logo, location, date code, fonts, etc.
  - Any signs indicating non authentic or mixed production require resolution
- **Package Check of Samples**
  - Dimensions and body for signs of sanding, blacktopping, clear coating
  - Mold markings and pin 1 identifier
  - Leads, plating material, straightness, signs of soldering on leads, etc.
  - Cracks, damage, co-planarity, etc.
  - Marking permanency, acetone test, scrape test & HST
  - Excessive heat signs from reclaiming
  - Any signs of refurbishment
- **Check for signs of mixed production lots – negates use of sampling**

CTI Components Technology Institute Inc.

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Decap Semiconductor Samples

- Select 3 random samples per lot/sublot, 20 ps or less, 1 sample.
- XRF test leads finish - SnPb or Pb free
- Decap - hermetic, mechanical or PEMs chemical
- Inspect for:
    - Correct OCM die - logo, name, number, etc.
    - Ink dot on die –indicates OCM reject.
    - Balls on top of ball bonds – repackaged die from scrap die
    - Condition of bond wires.
    - Signs of corrosion or acid attack.
    - Electrical overstress.
    - Photograph all observations.
- **Reject lot for any of these discrepancies**.

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Electrical Testing

- For 30 pc lot or 100%, for larger lots test 30 pcs /1000.

- Use OCM data sheet or Mil Spec. & competent lab.

- ICs, discretes level A require electrical test.

- DC & AC parametric @ 25^0C & min/max temp.

- Read and record parameters with min/max limits.

- Passives, levels A & B require electrical tests

- CCAP-101 defines types of tests to perform.

- Customer may specify additional tests.

- Failures, except minor out of tolerance, at 25^0C or temp extremes reject the lot/sublot as counterfeit.

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CTI Counterfeit Detection Program

- CTI created the CCAP-101 Certified ™© Program in 2008.
- There are currently 13 certified IDs and 5 in progress.
- There have been no reported counterfeit components delivered by the IDs.
- Counterfeits have been detected in many lots processed to the Program.
- The CCAP-101 Program is defined on web:

    http://cti-us.com/CCAP.htm

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Counterfeit detection practices

- Which of these practices will be accepted as adequate prevention to avoid counterfeit components?
  - AS5553
  - AS 6081
  - CCAP-101 Certified
  - IDEA 1010B
- The difficulty is that many detection criteria are subjective, require research, experience and interpretation to accurately implement.
- This is a necessity as *counterfeiters* are becoming so thorough.

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Certification Audit

- Can only be performed by CTI Inc. personnel;

- Certification approval, suspension or termination is performed by CTI, Inc. for cause;

- ID personnel must demonstrate knowledge of:

    - Approved procedures & handling practices

    - Reference documents

    - Performance to the procedures

    - Ability to interpret the inspection and test results accurately

- Reported delivery of counterfeit components shall result in suspension of certification and further delivery of components until issues are resolved to CTI satisfaction.

Difficult to Detect Counterfeits

- Photo examples of some counterfeit components which required extensive investigation to detect.

- Without extensive testing & inspection it is not realistic to trust any supplier.

- It has been reported that 80% of components supplied from China that were not purchased from OCM Authorized Distributors in China are counterfeit, i.e. refurbished, fake, substandard.

Difficult to Detect Counterfeits
Sand Blasting
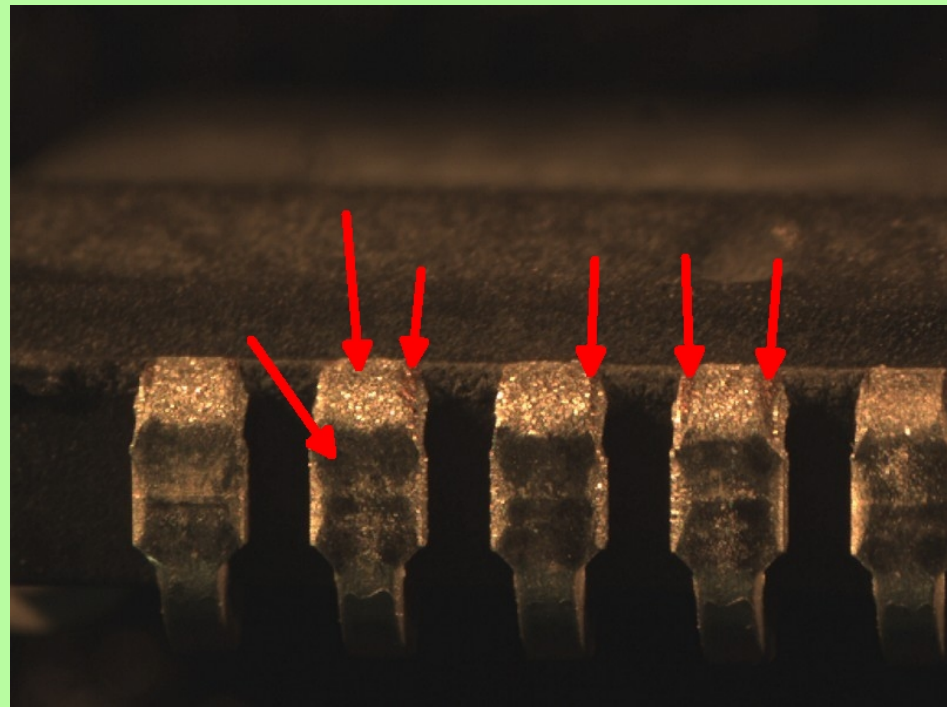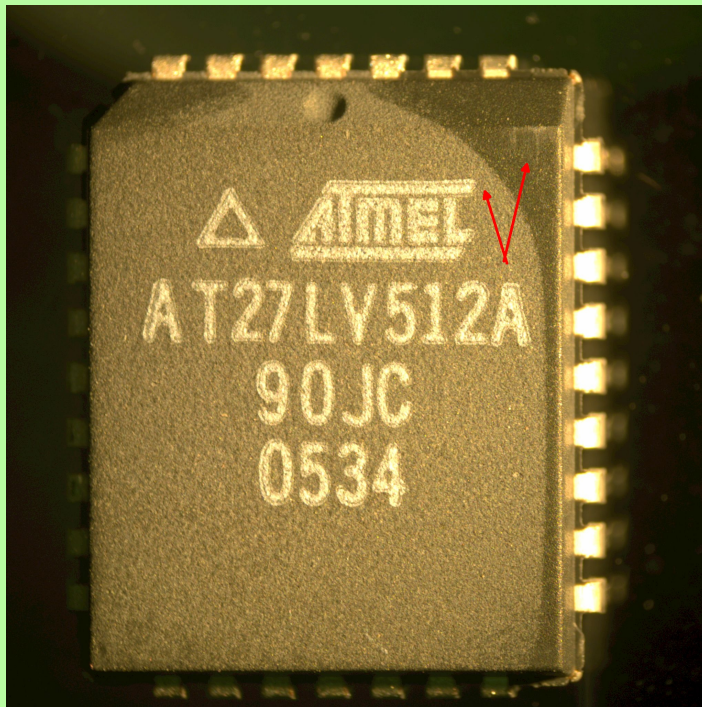
- Sand blasting is one technique for removing markings.
- This technique leaves very distinct signs plus the leads were not protected and show pitting.
- Sand blasting can also build up static charges that may ESD damage.

Difficult to Detect Counterfeits

Suspect Side Surface
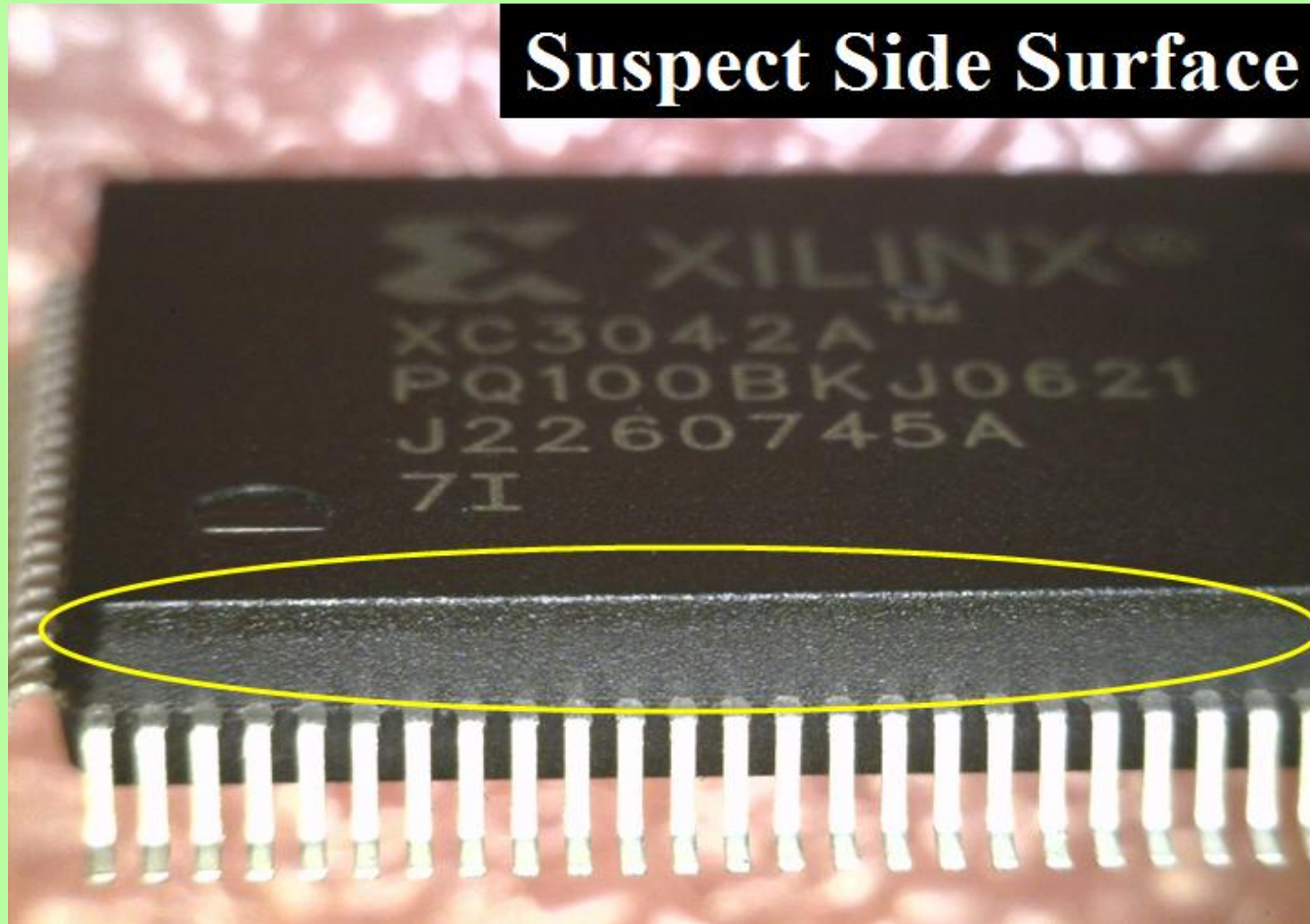
Surface texture difference indicates blacktopping.

Difficult to Detect Counterfeits

Authentic Xilinx markings
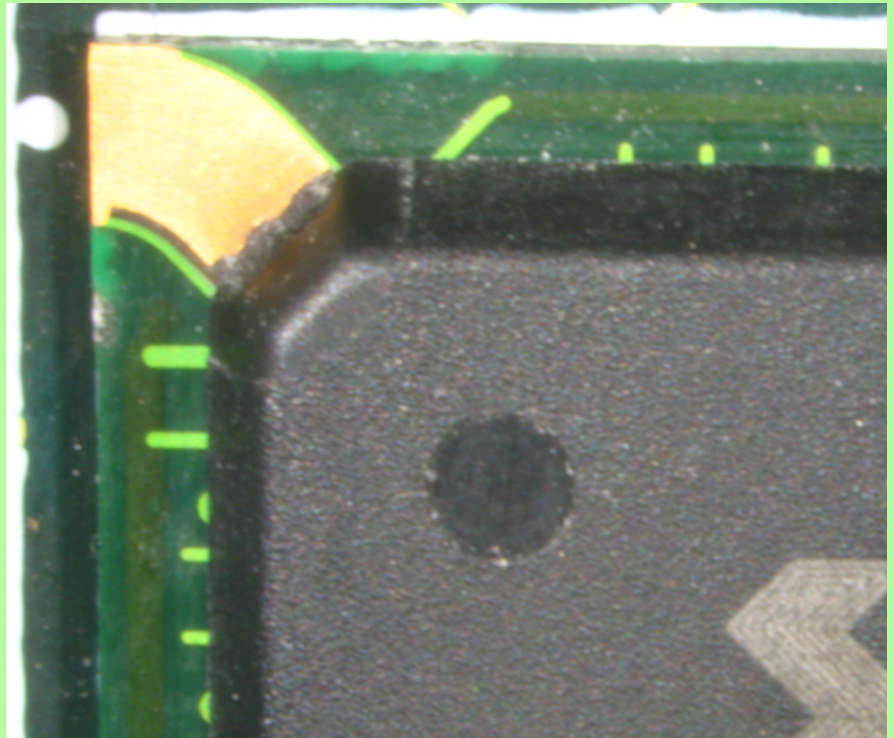
- Has Pin 1 & mold markings
- Does not show signs of black topping

Difficult to Detect Counterfeits
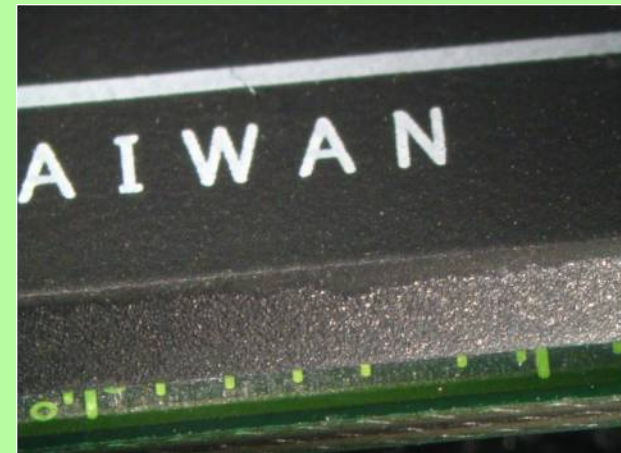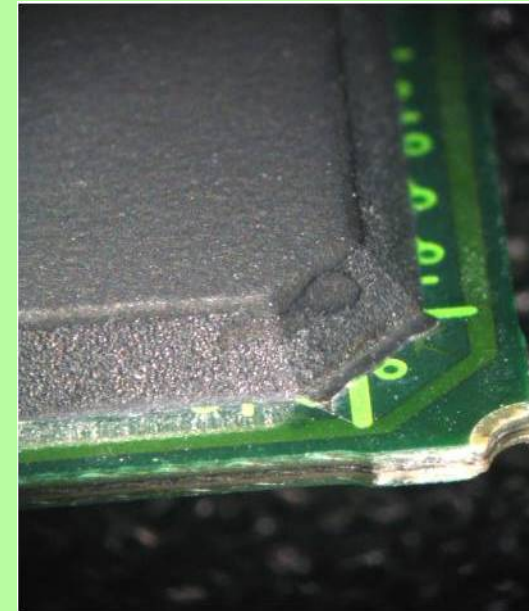
- **Visual inspection**
  - Ink marking looks good
  - Authentic parts were laser marked
  - No mold marks like authentic parts
  - Edge shows a coating on the top.
  - Remarked by someone

Difficult to Detect Counterfeits

- Acetone-resistant blacktop
- Four different solvents were tried.
- Dynasolve 711 removed markings; but did not remove blacktopping
- Uresolve Plus was found to dissolve the blacktop.

Difficult to Detect Counterfeits

- Dynasolve Uresolve Plus® was tried next – it removed the coating

- Sanding scratches under the blacktop were visible clearly

- Dynaloy® solvents are selective to certain coating compositions.

- The HST may need a variety of solvents to detect the epoxy coating..

- Xilinx IC offered in 2 temps, 3 speeds could be cause for OCM remark.

- Supplier may have changed markings to a newer date code – destroying an expensive authentic IC and making it a "counterfeit by remarking."

- **Question - Why do customers expect newer D/C on obsolete components ?**

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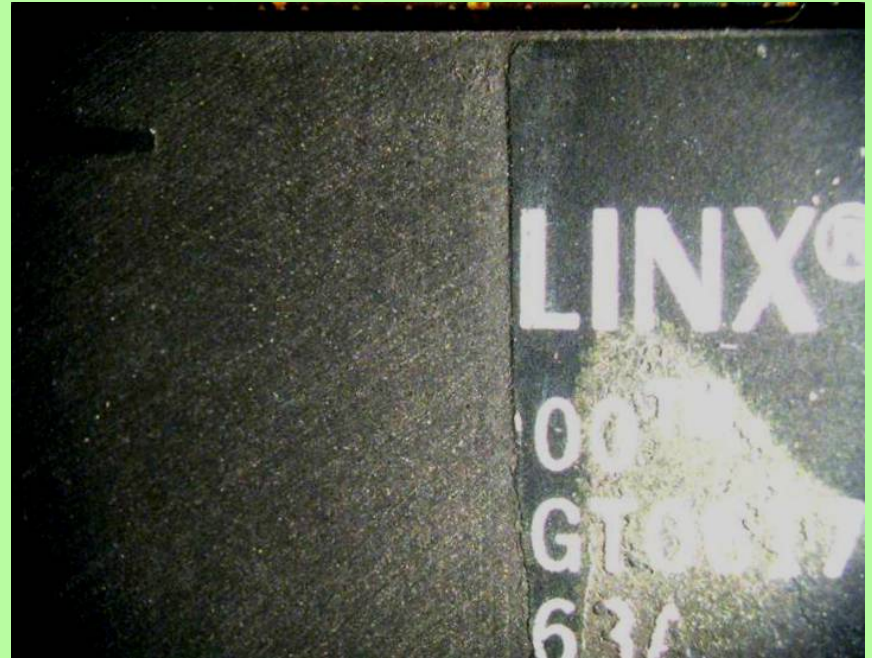
Difficult to Detect Counterfeits
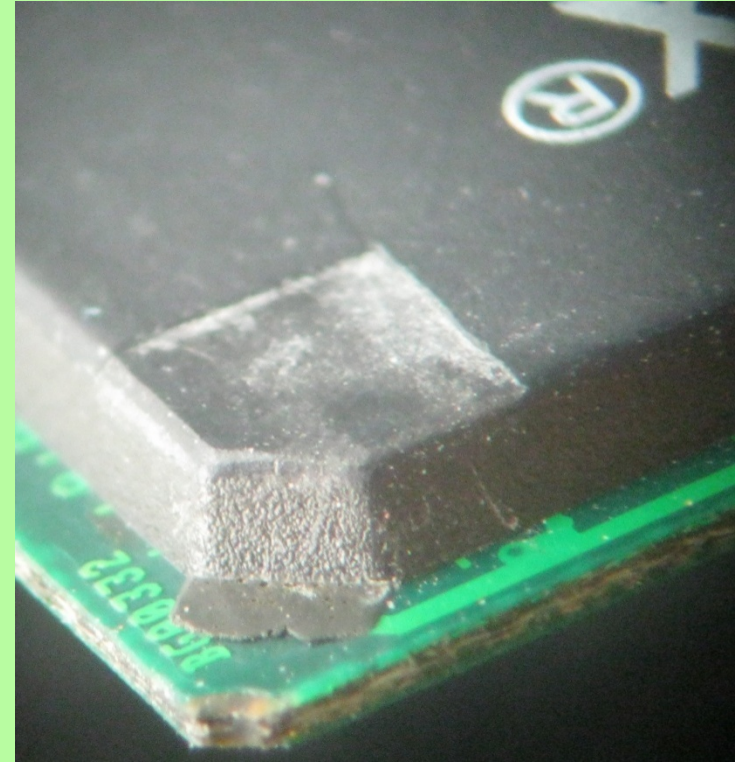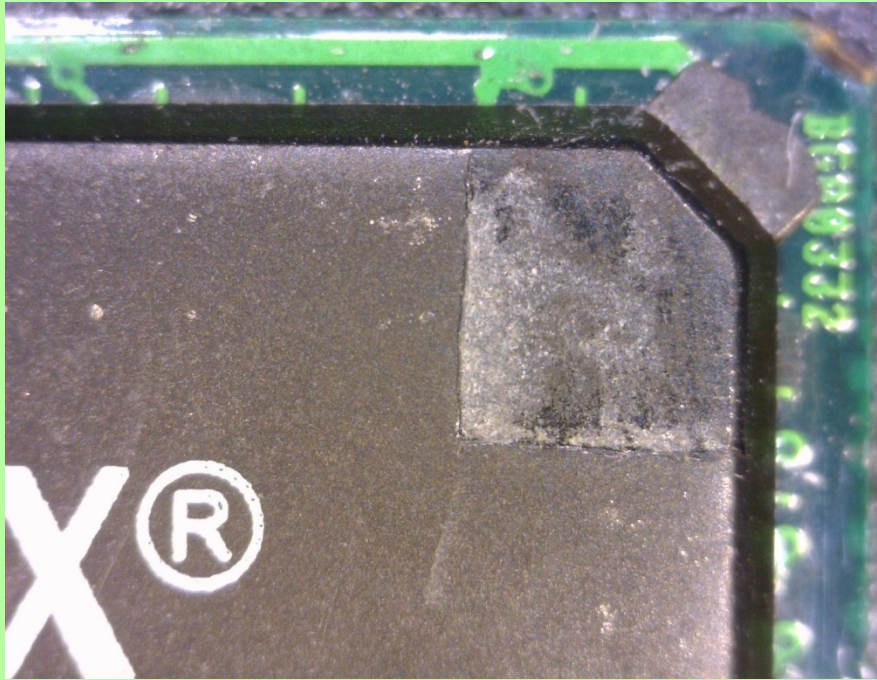
- Blacktop coating was definite & soluble only in Unrsolve Plus.
- Easily removed with scrape test.
- The scrape test is a substitue for HST but no view of sanding marks.
- Package material appears to have outflowed onto interposer board.

Counterfeit Part Examples

Example 5: Counterfeit parts that failed a programming sequence. Counterfeits had a three line marking sequence while the known good parts had only two lines of marking.

Figure 1: Photo of suspect part.

PLDC20RA10-25DMB
5962-9055502LA
Q101271 THA0231

Figure 2: Photo of Known Good Part

5962-9055502LA
Q709468 THA0424

Cypress logo is a tree. Look at the fine details of the tree One on left is counterfeit QML component .

Difficult to Detect Counterfeits
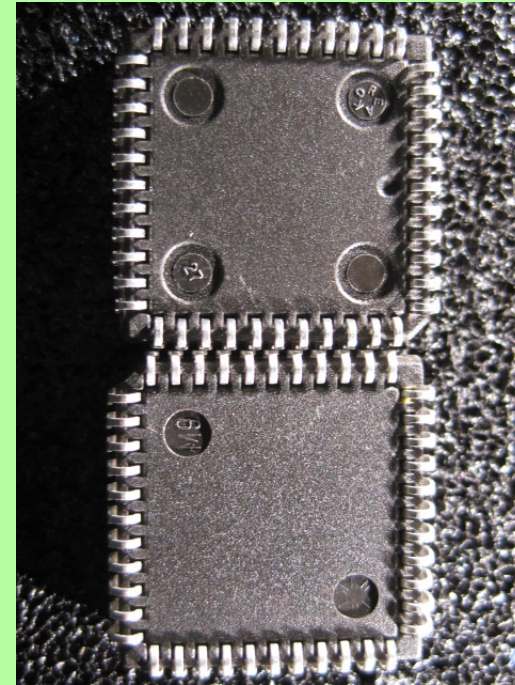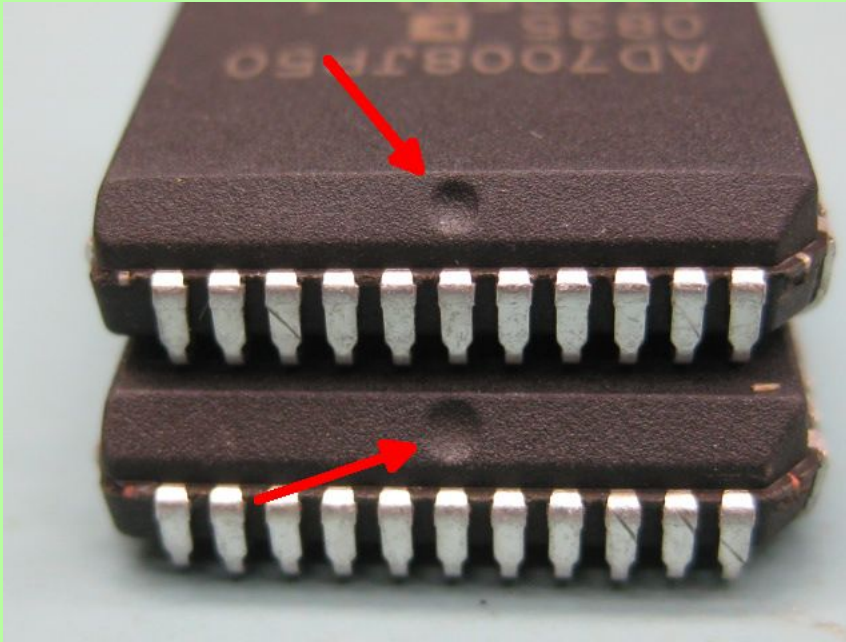
AD 7008JP50

Same P/N, same date code, same plant but different bottom mold marks and Pin 1 identifier

Difficult to Detect Counterfeits

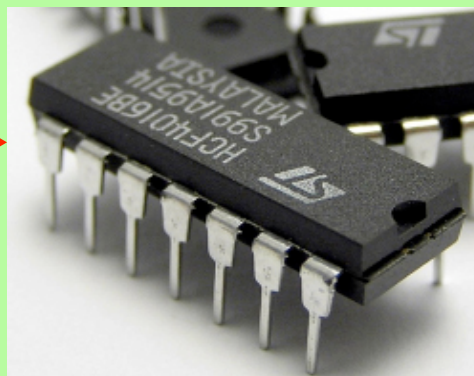## AD 7008JP50
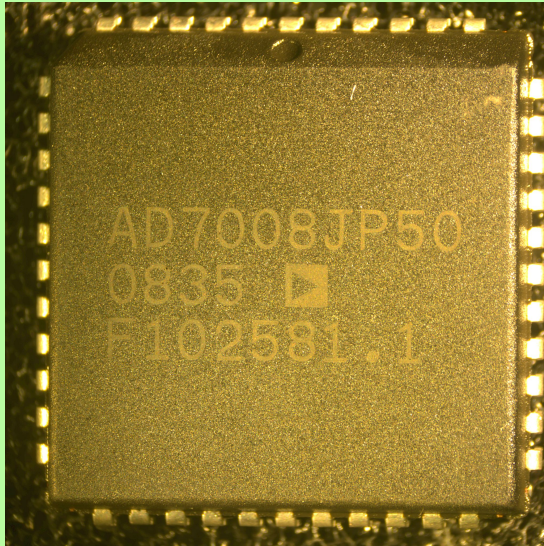
Acetone test
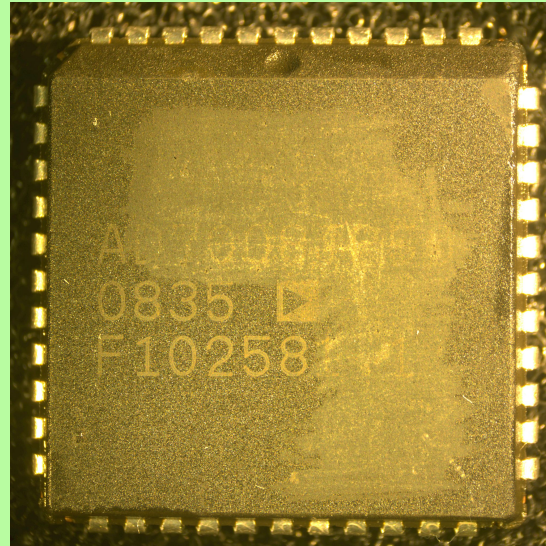
Dynasolv 185
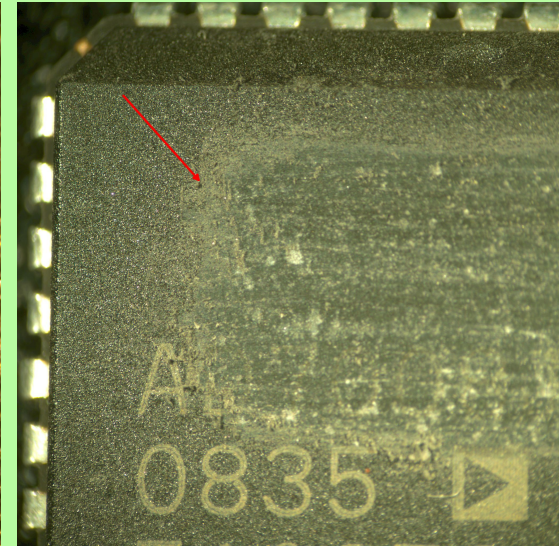
Scrape test

Scrape test works when person is experienced.

Difficult to Detect Counterfeits
Building Counterfeits - **Major new threat**
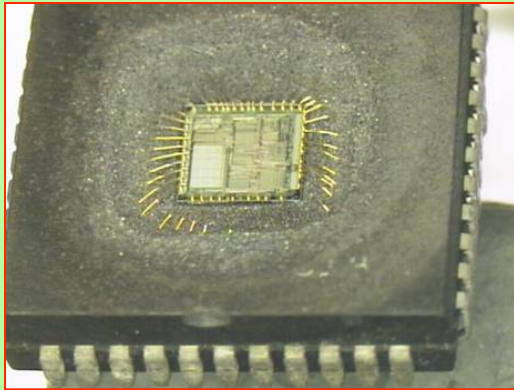
Rare or obsolete P/N dice are harvested from decapped scrap plastic parts, repackaged in mil-style or PEM package, relabeled, and sold to military or mil contractors for much higher price.
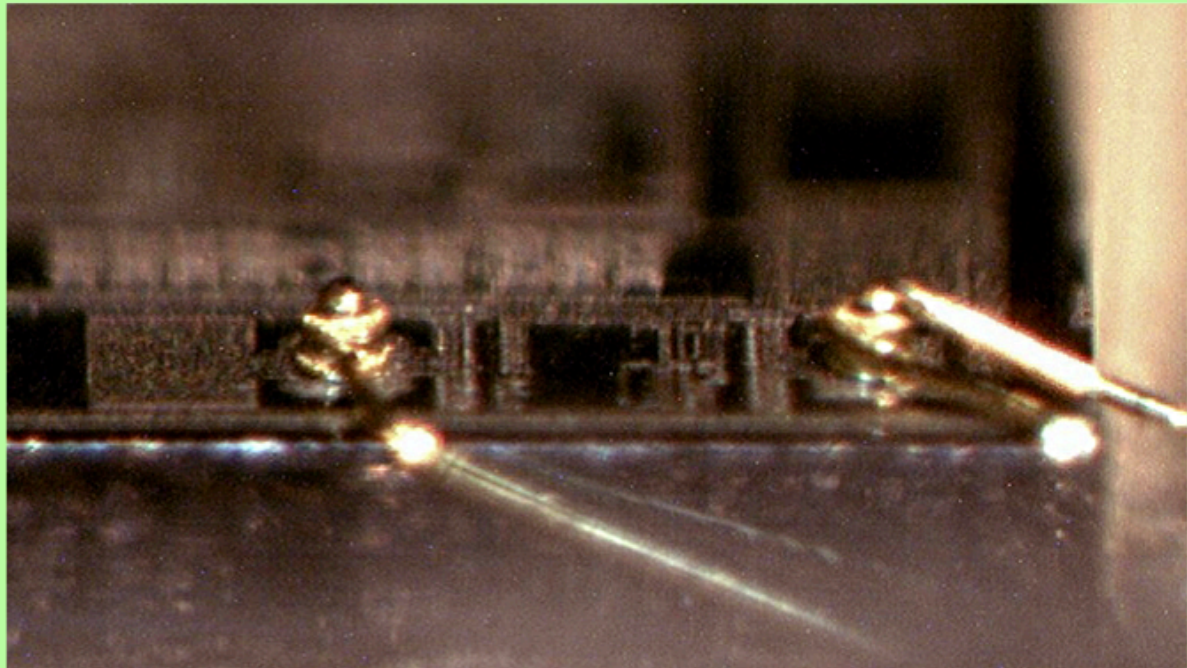
Detection:
- **Markings**
- **Logo**
- **X-Ray**
- **De-cap**
- **Elect. Test**

Difficult to Detect Counterfeits

Building Counterfeits - **Major new threat**
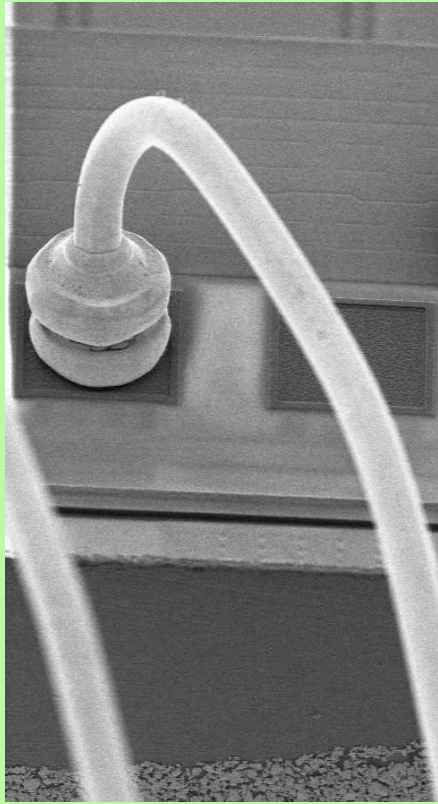
Simulated & SEM Photo

This is how new bond on top of original bond looks. NEW COUNTERFEIT Requires decap and hi mag optical inspection, may be detectable with high resolution x-ray
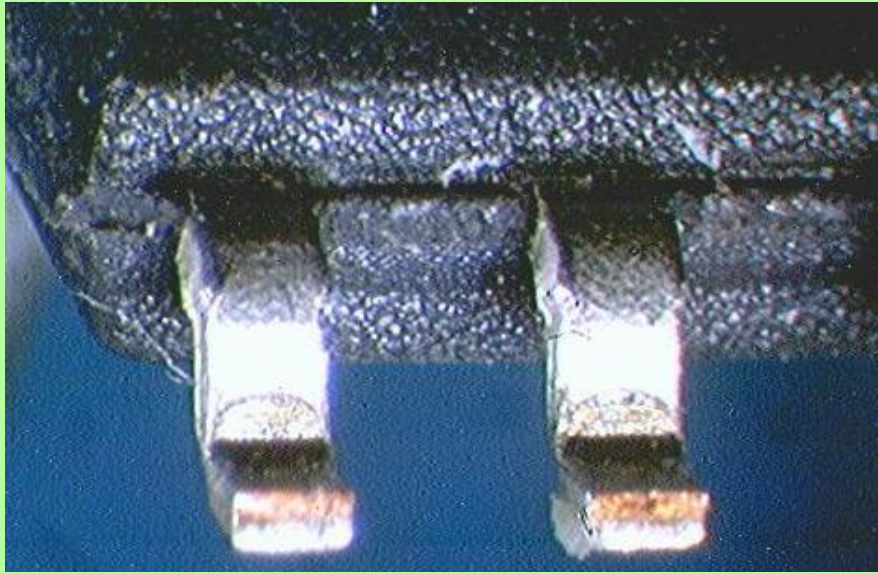
Difficult to Detect Counterfeits

AM29LV040B

Mangled leads and surface texture looks abnormal.
Dynasolve lightens coating & markings.
Another Dynasolve removes coating, reveals abrasion marks.
These are reclaims and remarks = Counterfeit

Difficult to Detect Counterfeits

- Example of places to inspect leads for indications of previous use. End of leads do not show solder from previous use, but bottom of leads do, due to solder thickness.

- Exposed copper on lead ends is NOT a defect and is NOT counterfeiting, results when sheared from lead frame

Difficult to Detect Counterfeits

Another Lead Check

- Photos show the malformed contact portion of lead and lumps of metal attached to the back this is most likely the residue of the solder remaining on the leads when they were pulled from a board.

- The normal tooling that shears the leads from the lead frame leaves the corners square, not rounded.
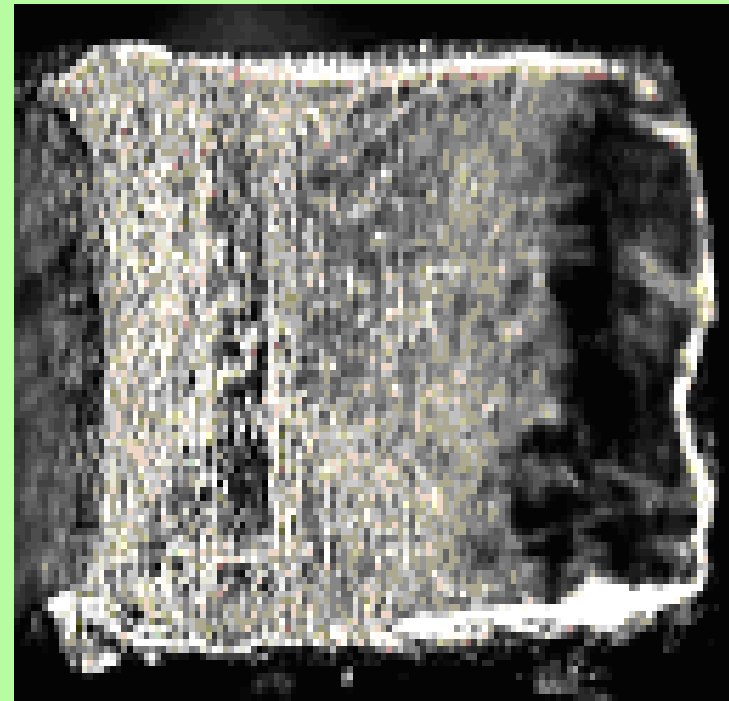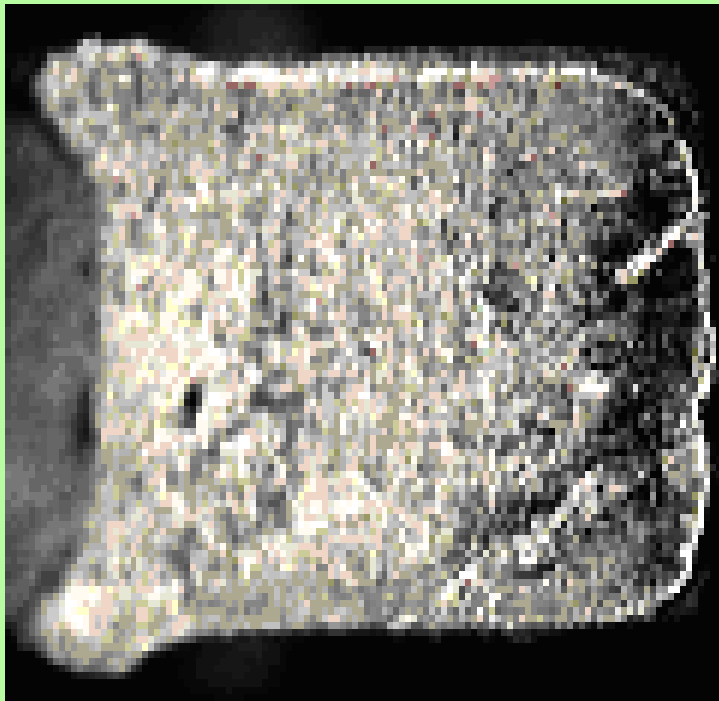
Recent Counterfeit Experiences
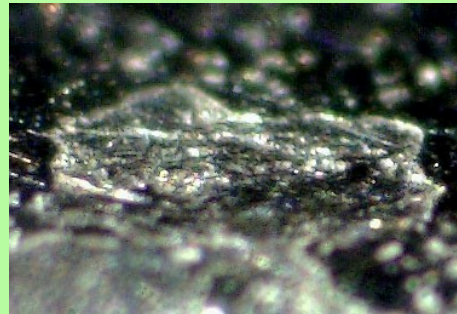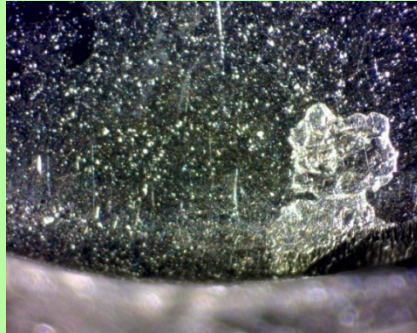
Logo wrong.

Logo correct.

Intersil HA2542

- Power Op Amp, now obsolete
- The Intersil logos have changed over the years, but aspect ratio is wrong.
- Intersil acquired Harris in 1990.
- Top surface of cap had peculiar "speckling" appearance visible regardless of light source type, consisting of dried coating particles and embedded dirt.
- Scrape test of top surface revealed chipping of clear-coat.
- Sanding striations observable at edges of cap

• Logo on packages are phony because of aspect ratio.
The bottom of the "i" under the dot in the "i" should be a rectangular, not square.