IPC Midwest 2011

Authenticity Testing

LaShawnda Scott

Trace Laboratories

Executive Summary:

Counterfeit and substandard parts and components have been a recurring theme in practically every market. For the last several years, the largest concern has been in the military and aerospace industries. Many of these re-marked and recycled parts are coming back into the US from electronic waste that was sent overseas. In an attempt to mitigate risk and potentially eliminate use of counterfeit and substandard parts, it is important to develop a counterfeit inspection procedure for incoming materials. This inspection can be as basic as a visual examination but becomes more successful at identifying potential counterfeit components and parts when a few more techniques that are advanced are employed. This webinar will present background regarding the counterfeit market as well as provide information on various tests and testing techniques for identification of counterfeit parts.

Outline:

Background Information

Types of Testing:
Non-destructive
Visual
- X-ray
- Electrical

Destructive
Lead Finish (XRF, EDS)
- Remarking/Resurfacing
- Decapsulation/Delidding

Authenticity Testing

LaShawnda Scott
Trace Laboratories

Acknowledgements

- Cathy Moritz
- Ronald Roden

Developing A Program

- Why?
  - Growing Problem
  - End user requirement – Risk Mitigation
- How?
  - Basics
    - Minimal Necessary Equipment
  - Advanced
    - High tech equipment

Non-destructive Testing

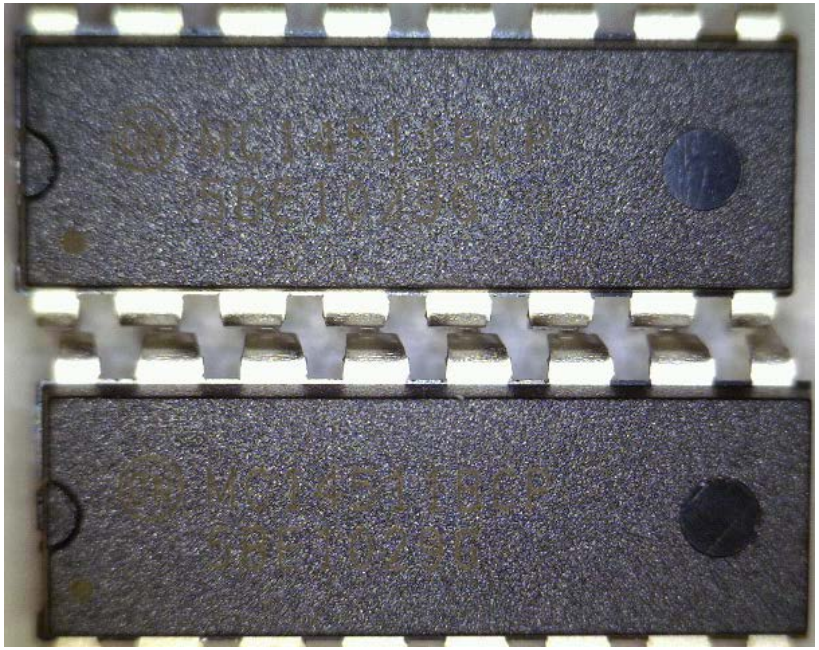
- Larger Sample Set
- Visual
  - Magnification
- X-Ray
  - Internal
- Electrical
  - Dependent upon type of component

Destructive Testing

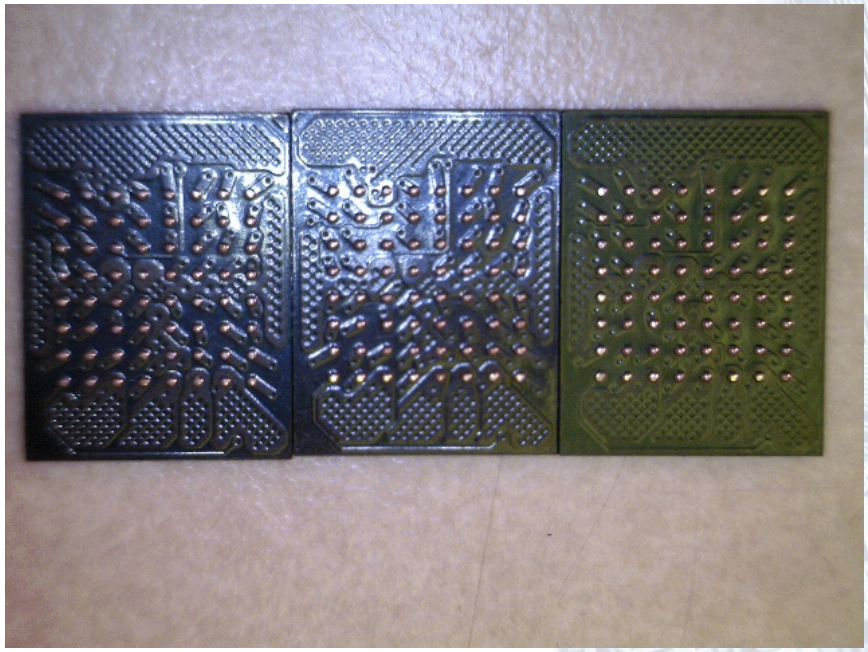
- Representative Samples
- Remarking and Resurfacing
  - Various solvents
- Lead Composition
  - Pb
  - RoHS
- Decapsulation
  - Internal verification of die

Visual

- Compare
- Marking
  - Font
  - Logo
  - Ink
  - Position
- Mold Cavities
  - Depth
  - Position
  - Well-defined
  - Texture
- Dimensions
- Leads
  - Corrosion
  - Insertion Marks
  - Broken or Missing
  - Bent
- Surface Texture
  - Top to Bottom
  - Sides/Between Leads
  - Difference
- Inconsistencies

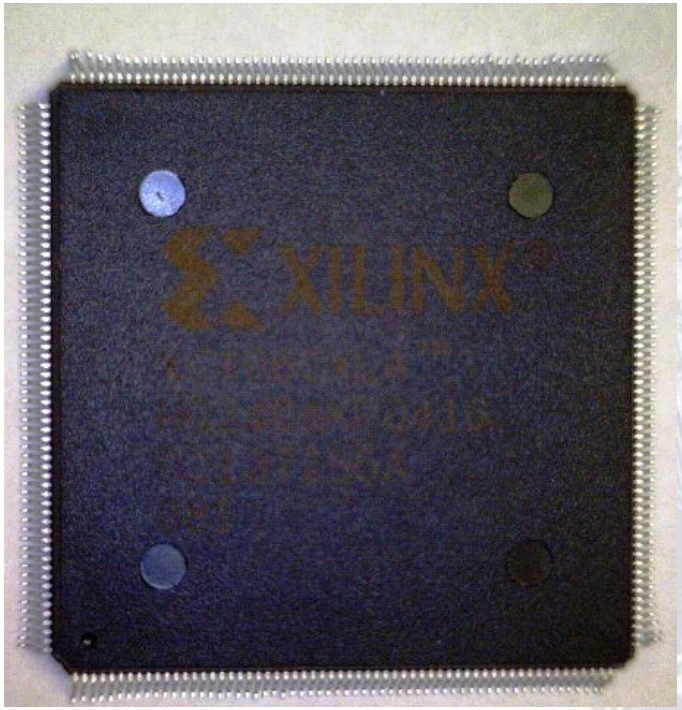


- Tops have the same orientation
- Bottoms are opposite orientation

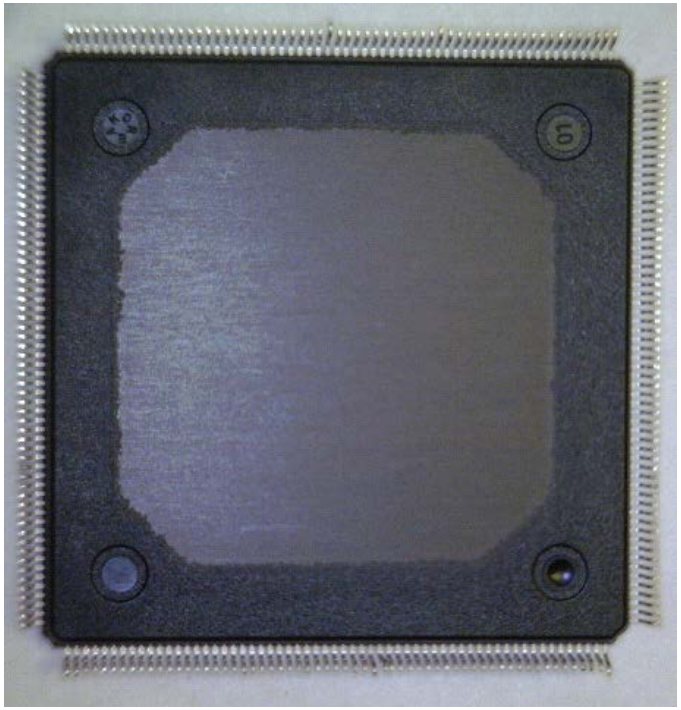


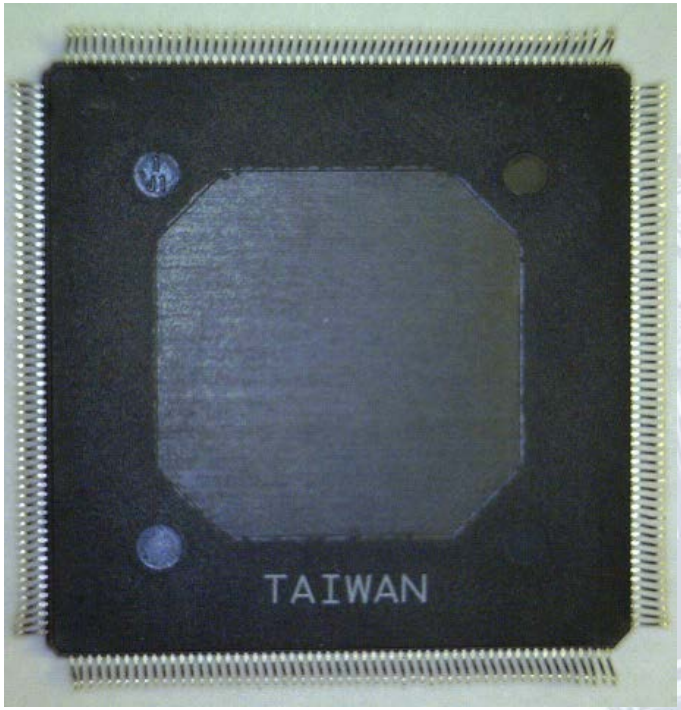
- Top surface color variation.
- Bottom surface color and masking pattern differences.

Corner radius differences on ID plaque.

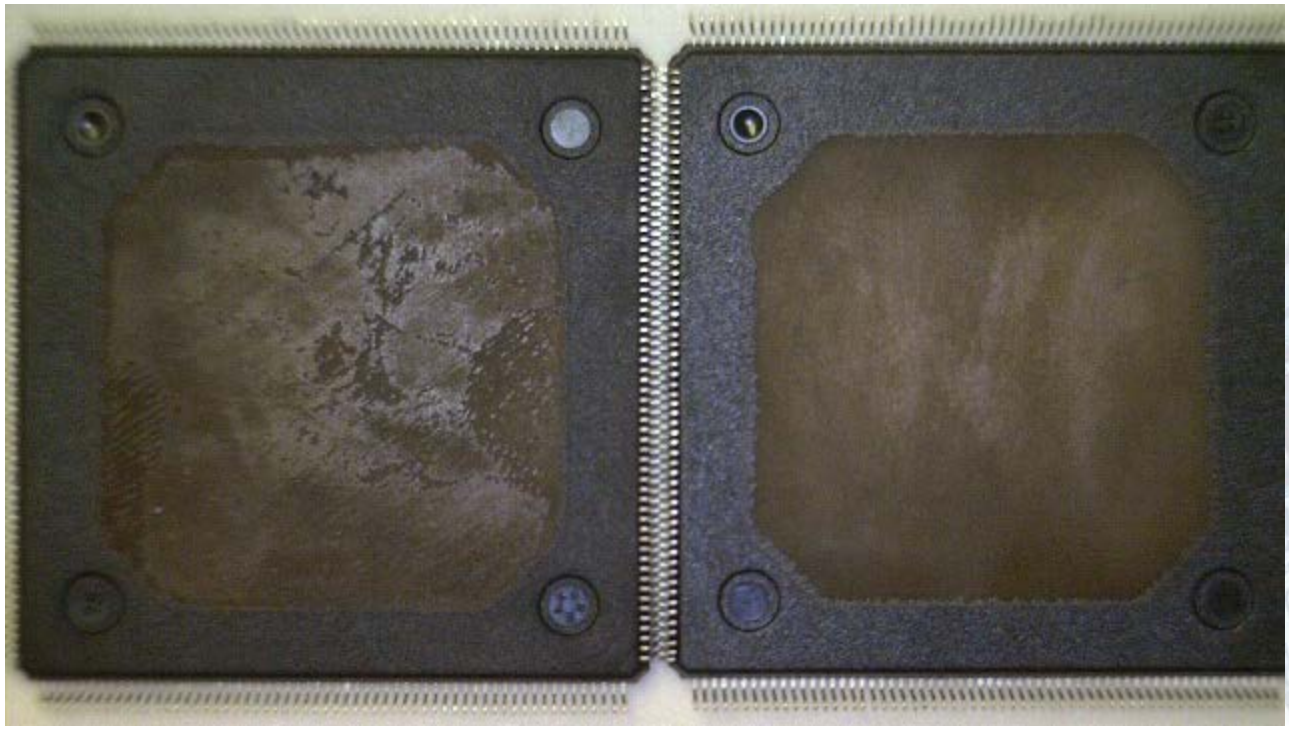


- Parts received as same lot.
- Marking differences.
- Mold cavity differences.

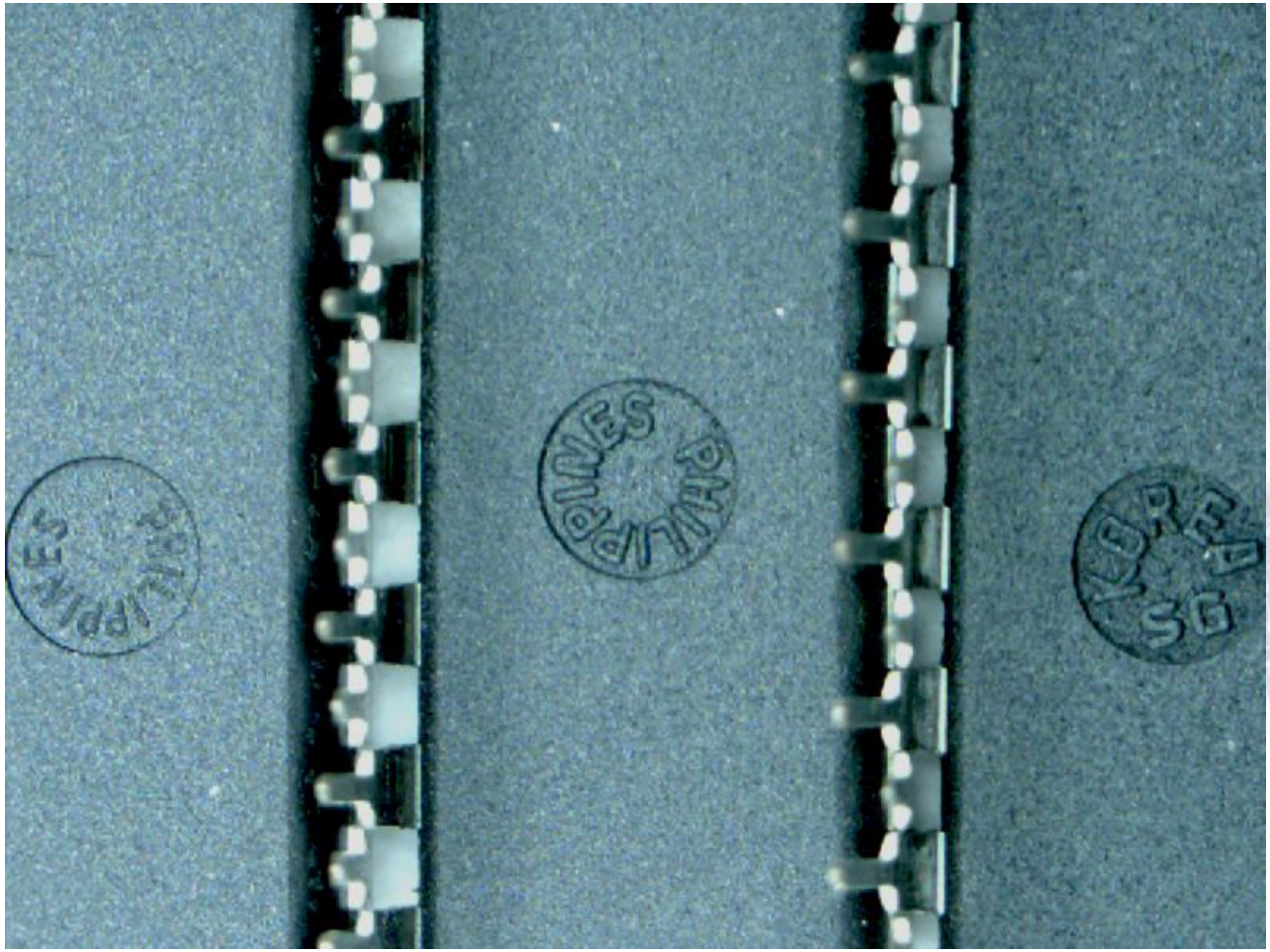




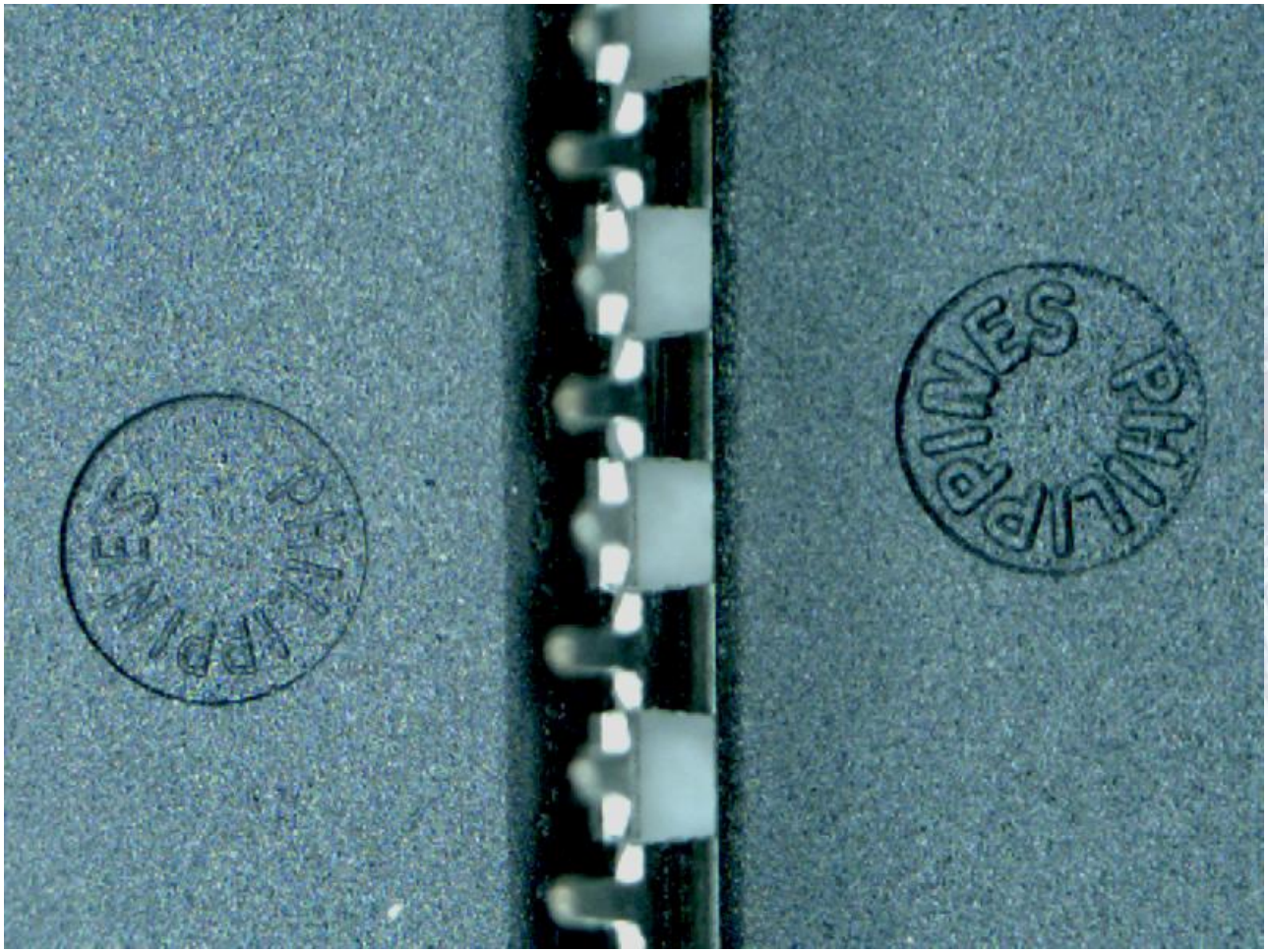
- Country of origin
- Mold cavity differences
- Package material vs center material

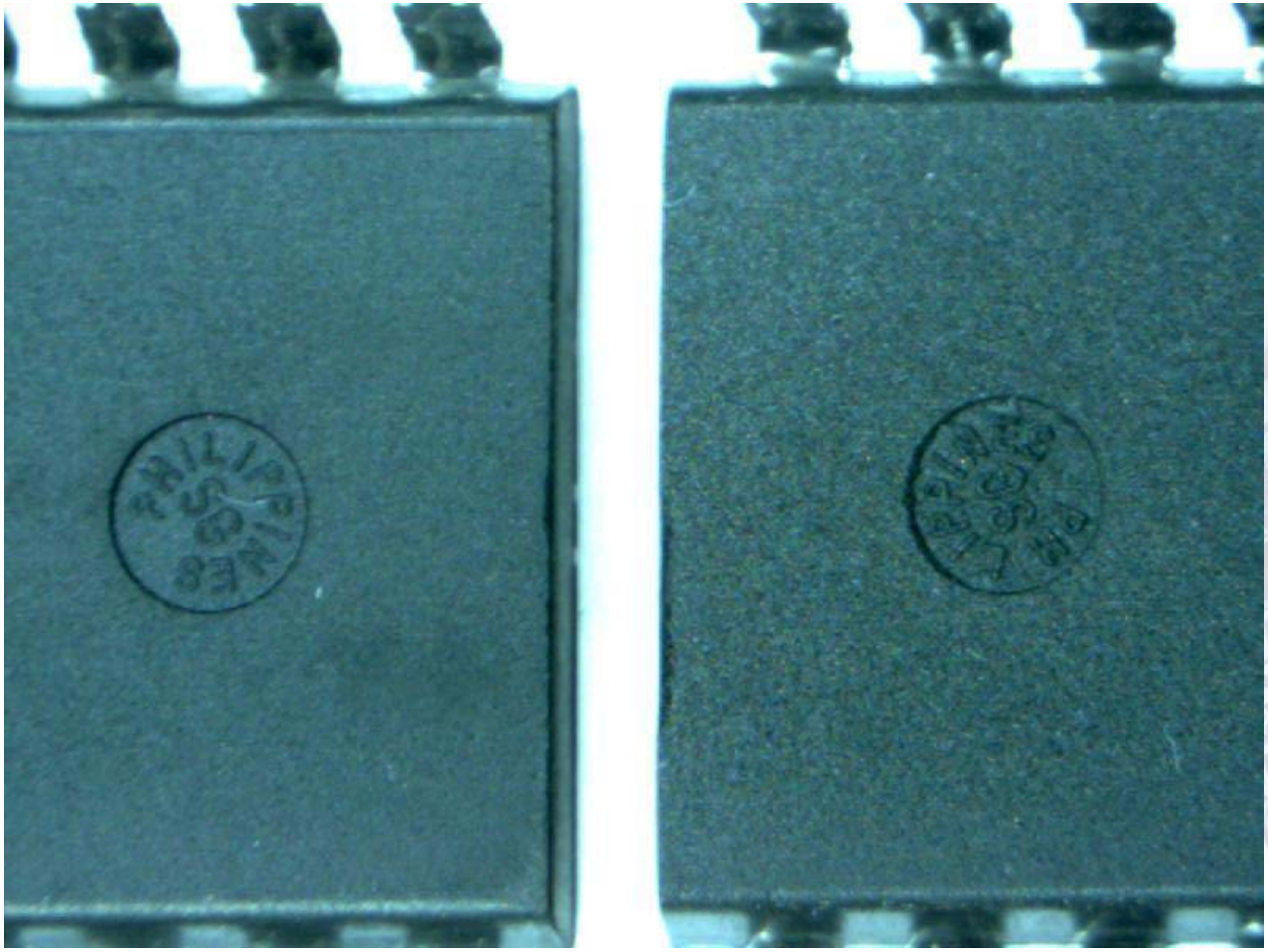


- Mold cavity differences
- Material in center



Country of Origin (COO) differences within same received lot


PHILIPS



Country of Origin (COO) differences
within same received lot


INDONESIA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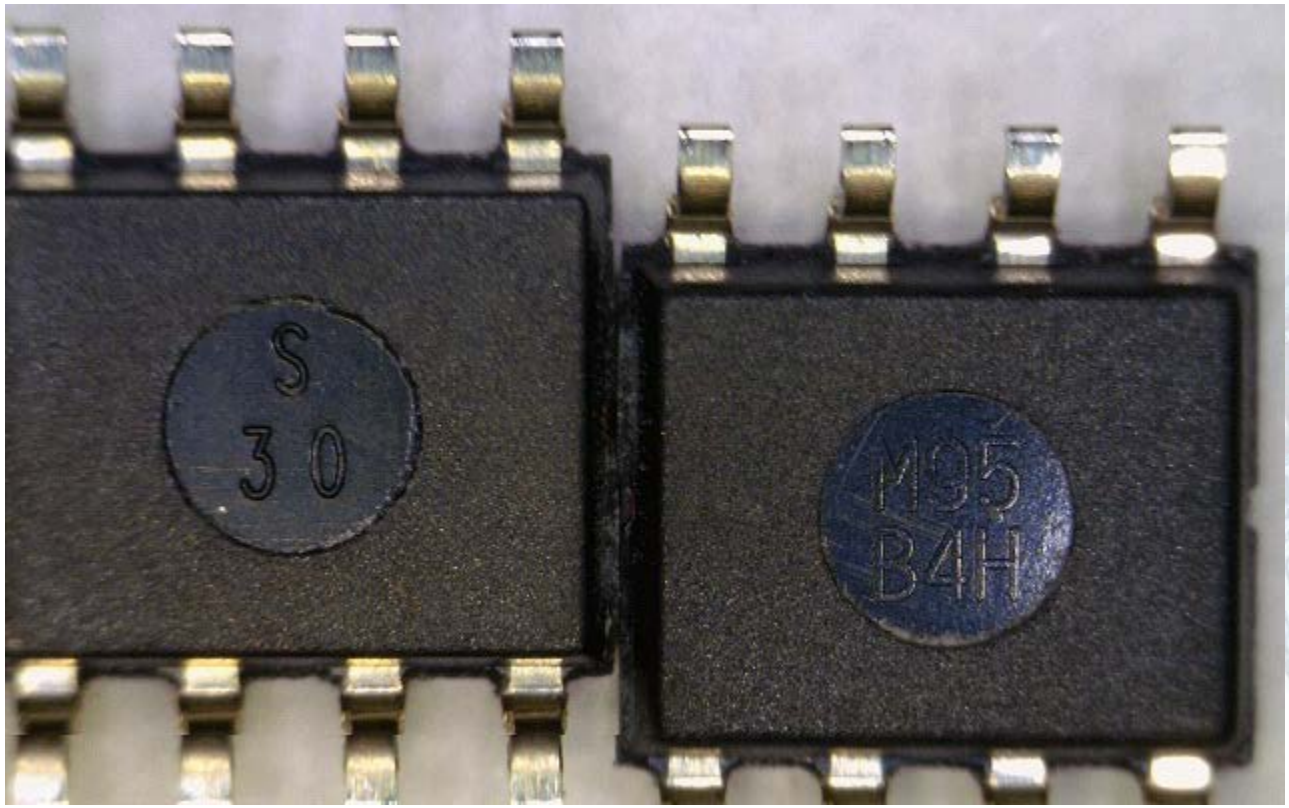
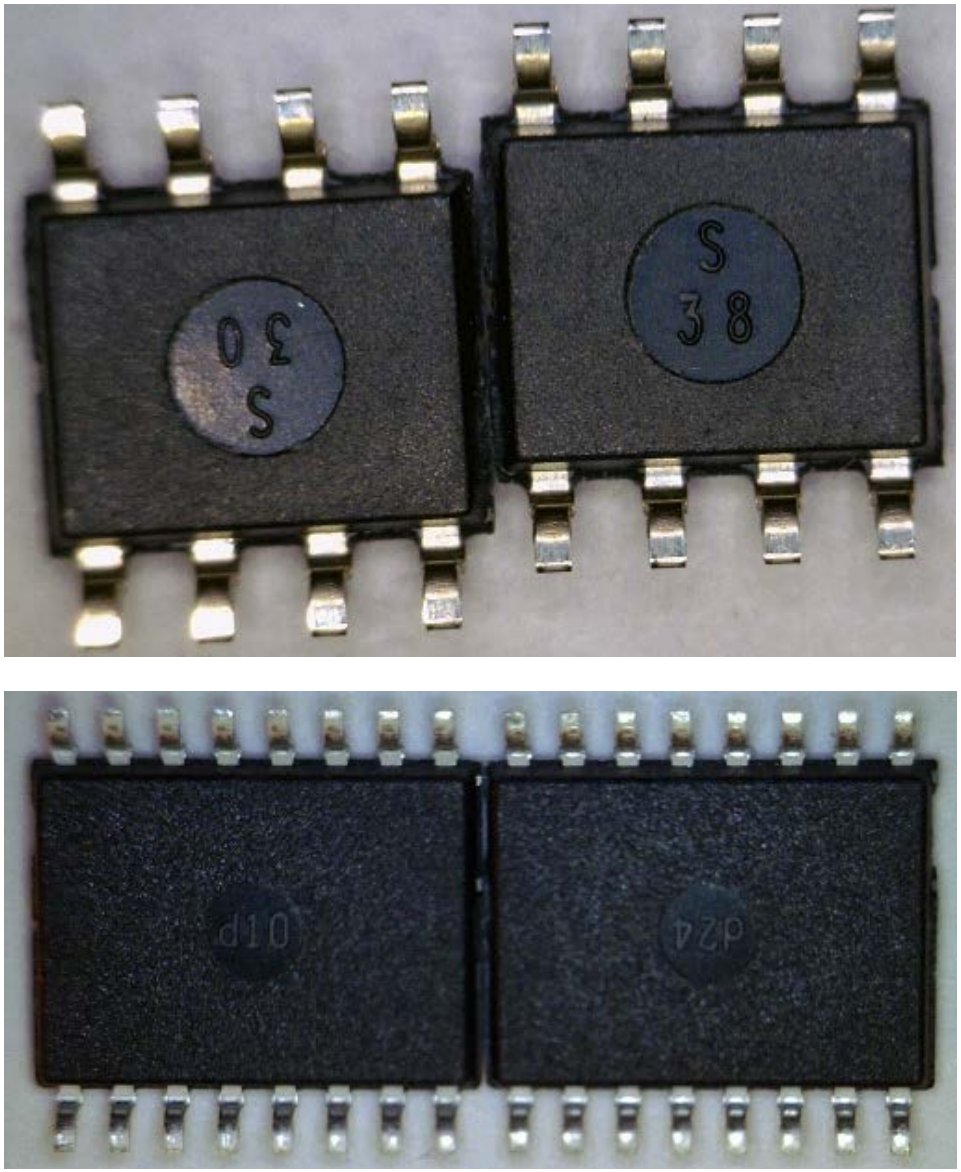
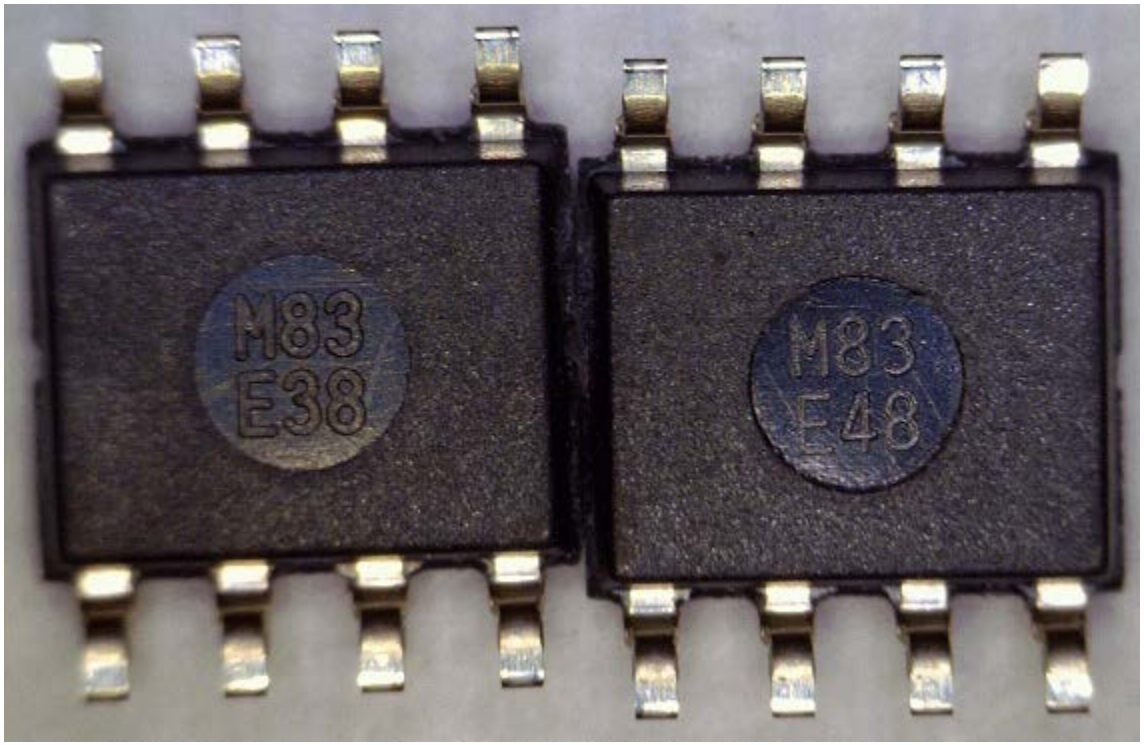


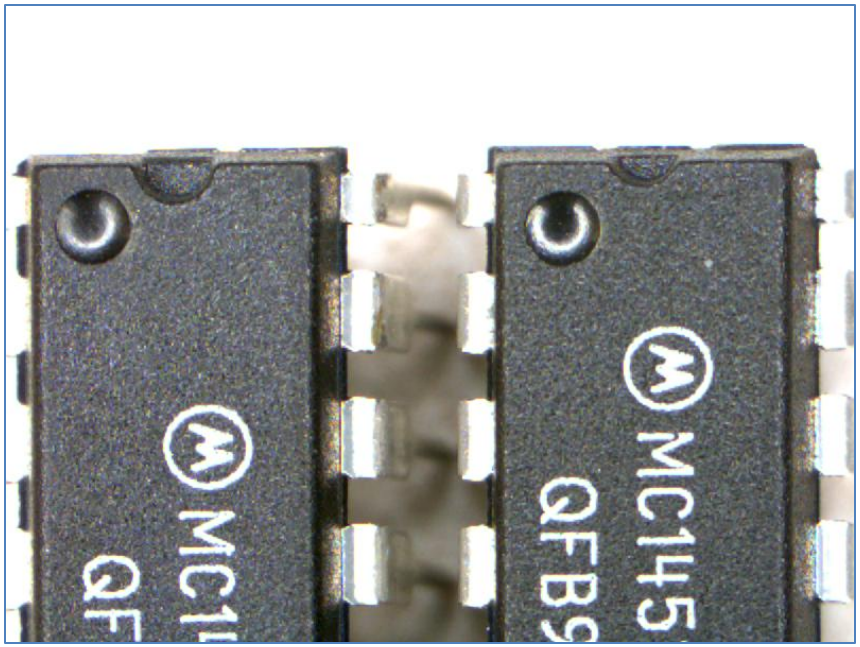
Differences in lot marking

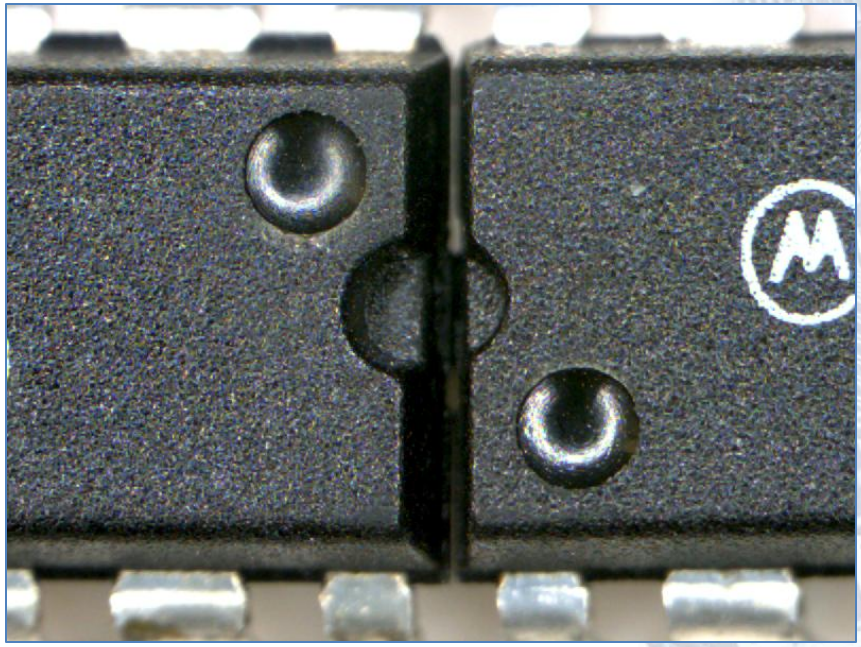


Lot marking orientation

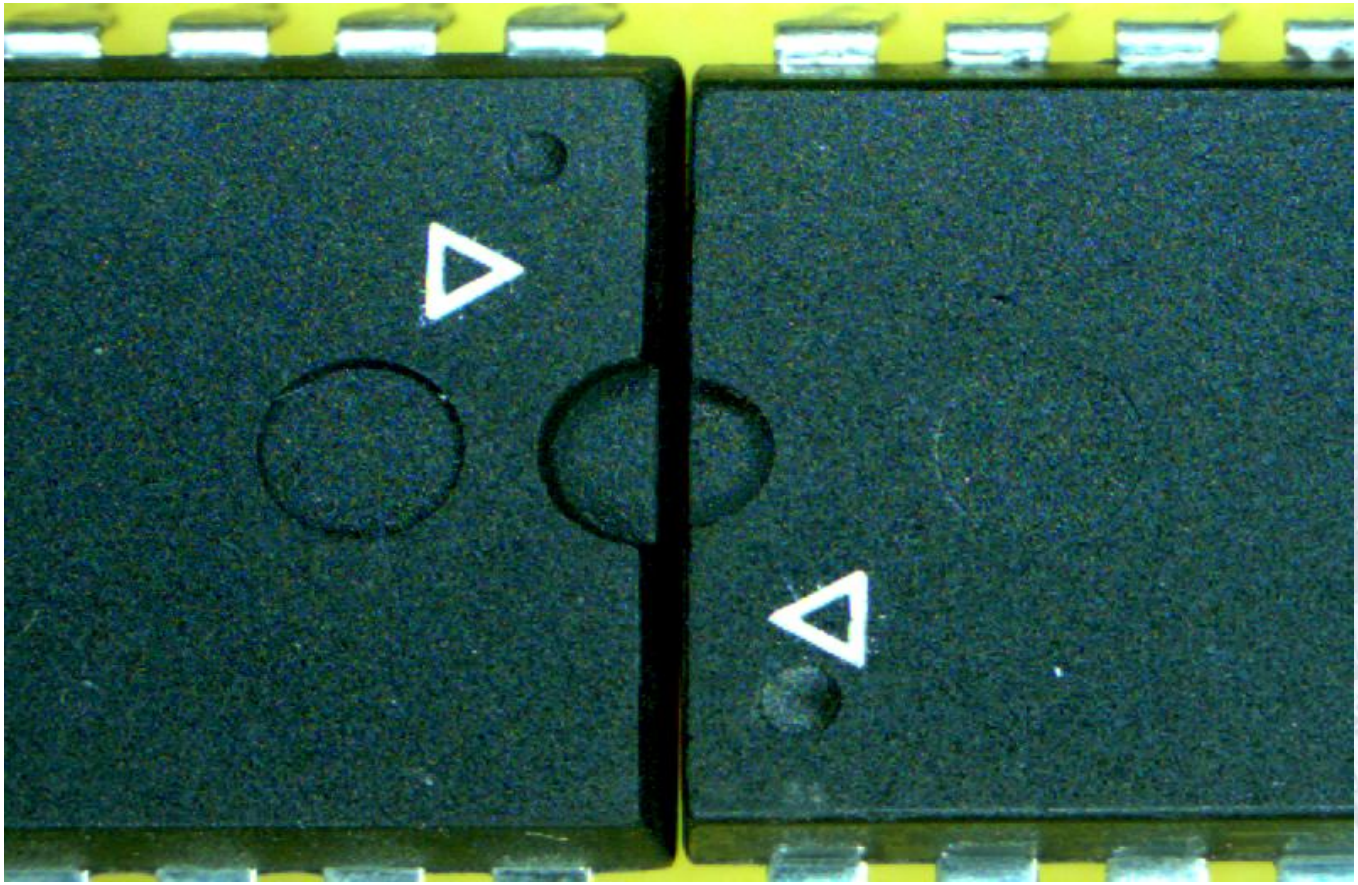


Lot marking differences



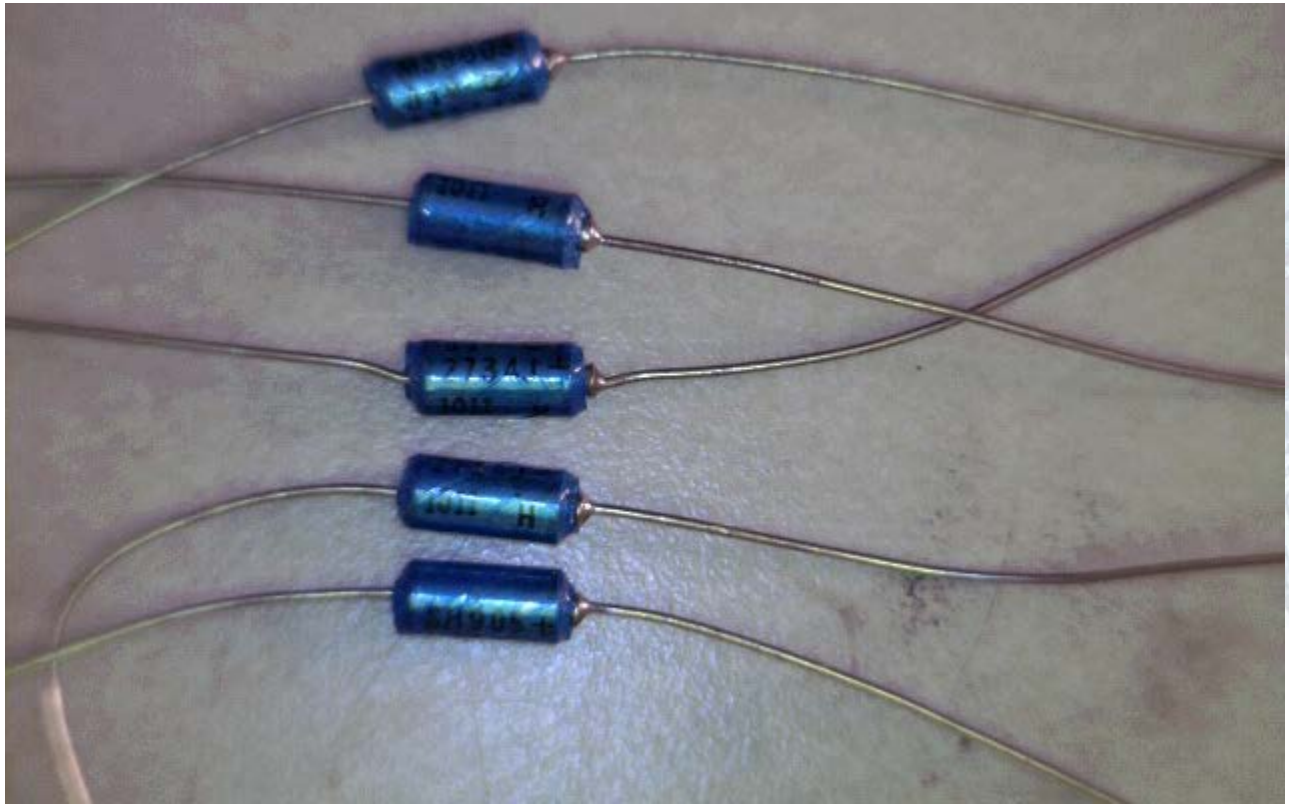


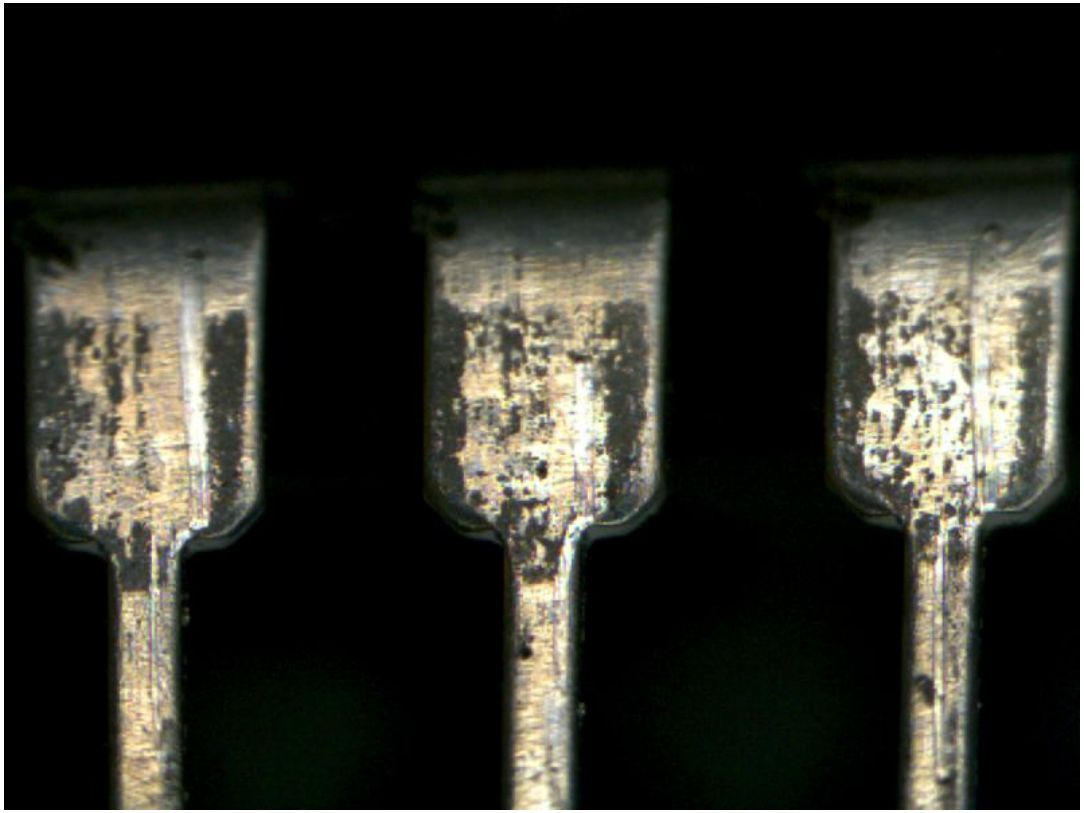
- Marking location
- Size of notch



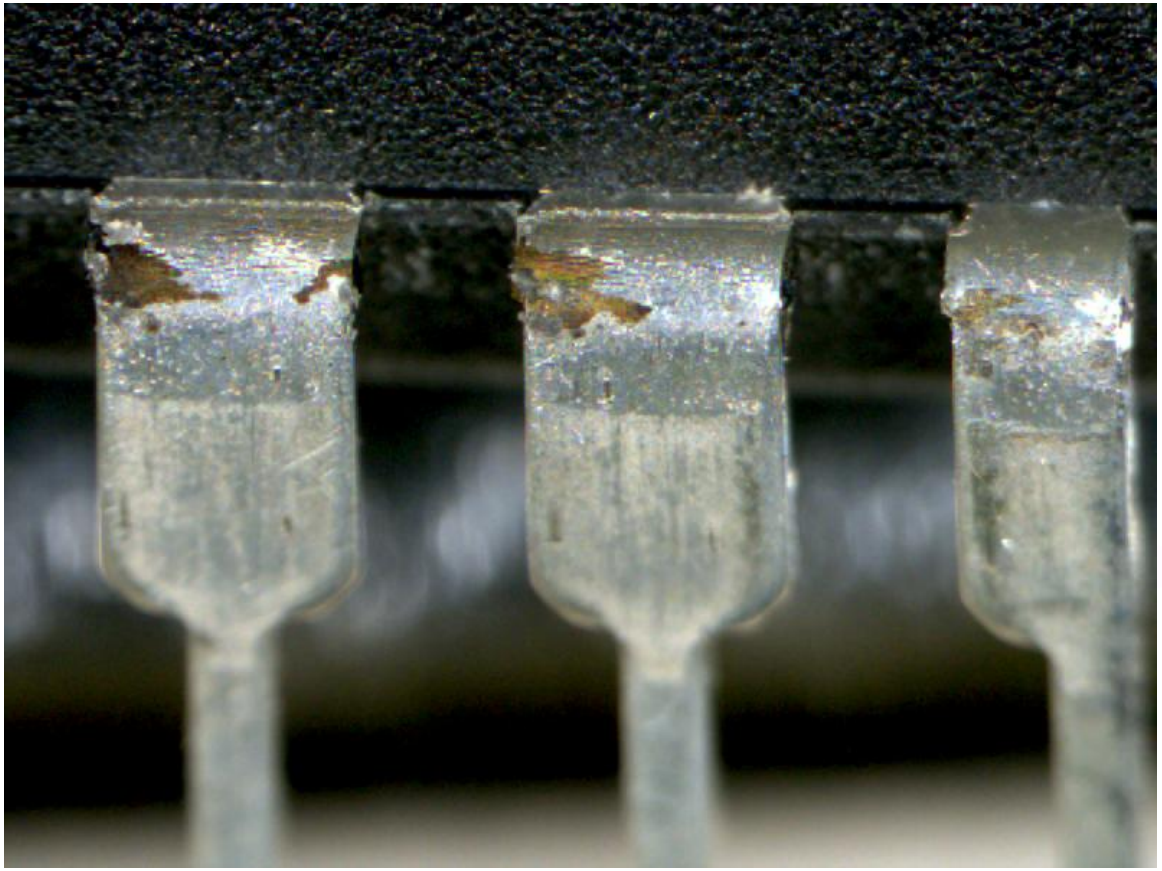
- Size of notch
- Size of dimple
- Mold Cavity Differences

Wear/Fade evident on part





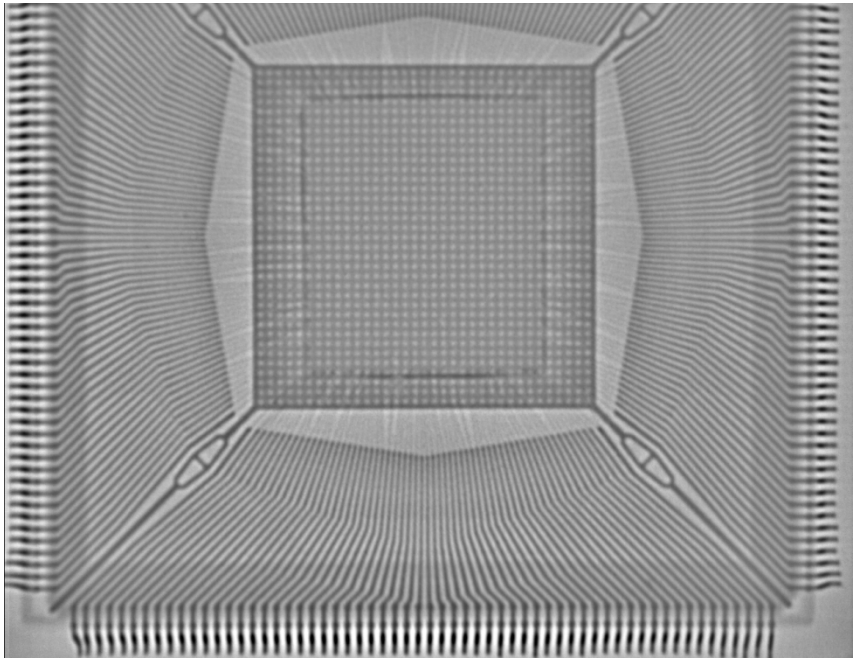
Insertion Marks

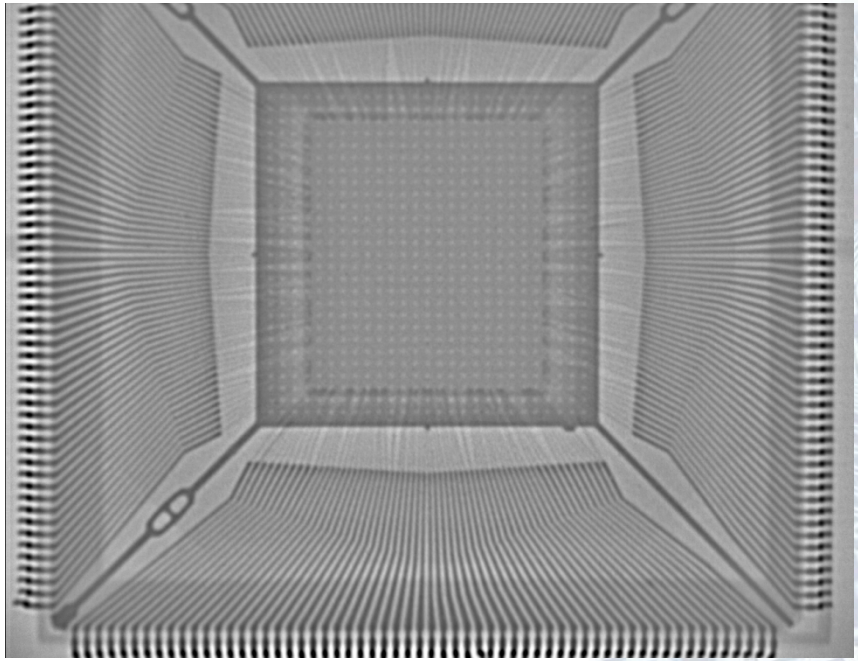


Lead Corrosion and Insertion Marks

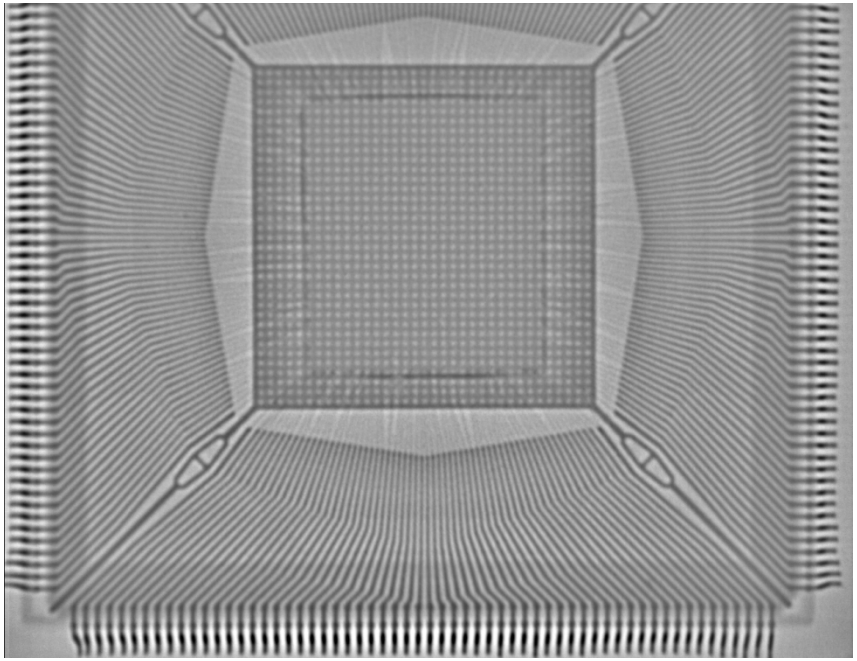
X-Ray

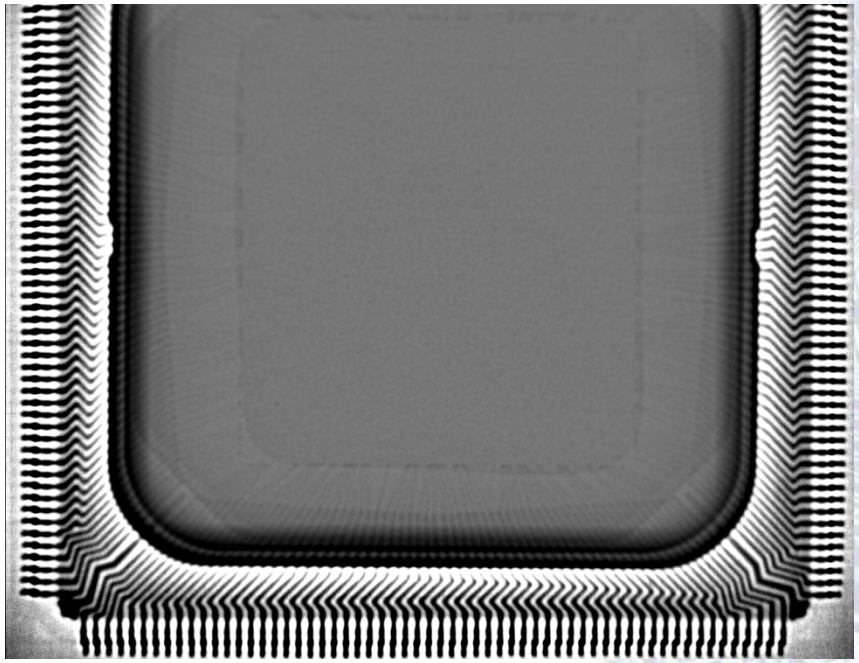
- Compare
- Internal Structure
  - Arrangement
- Traces
  - Shape
  - Arrangement
  - Orientation
  - Number
- Die
  - Position
  - Shape and Size
  - Orientation
  - Wire Bonds
  - Bent
- Defects
- Inconsistencies



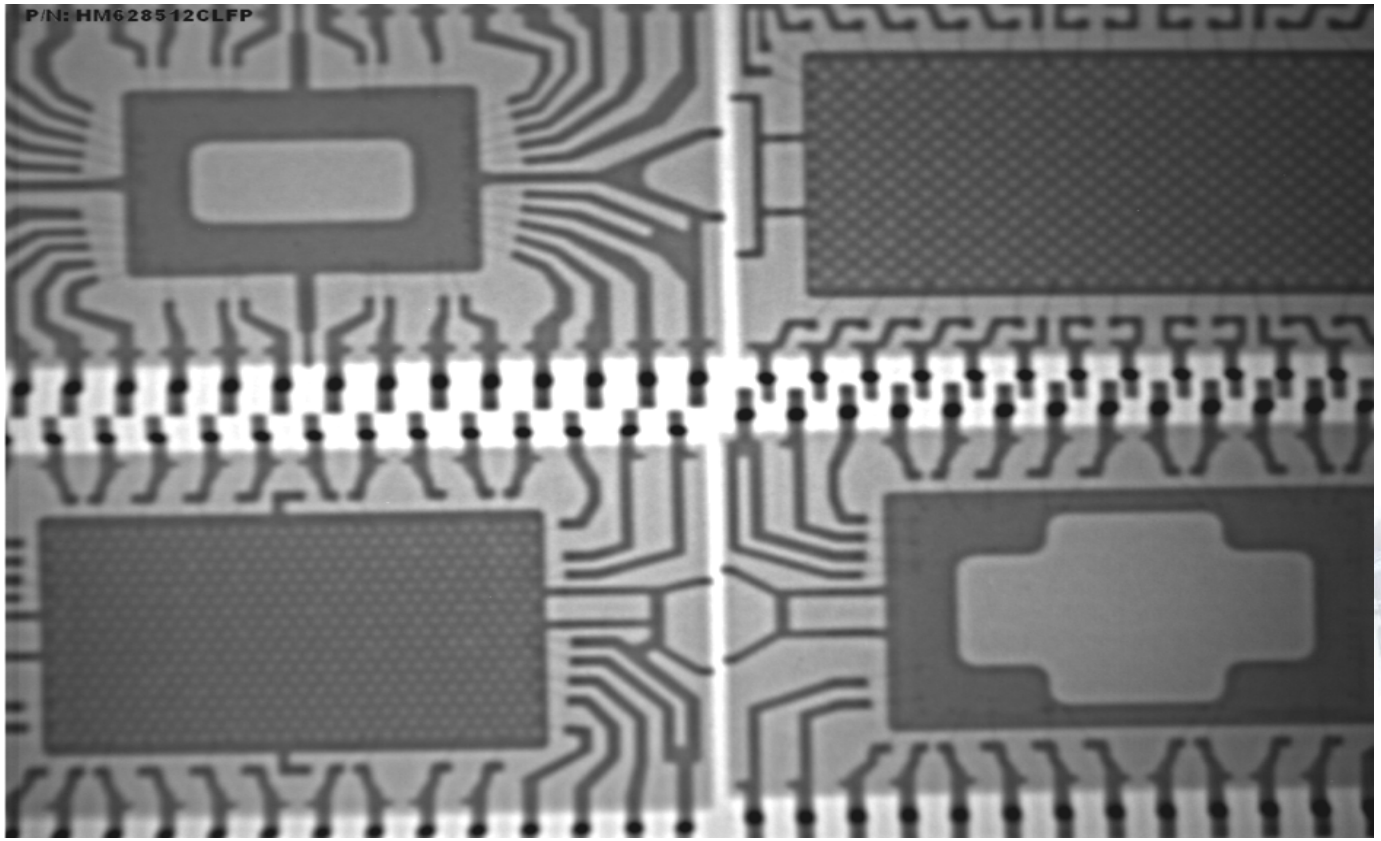


- Arrangement
- Orientation
- Shape





- Same appearance on visual examination
- Internal differences found during x-ray



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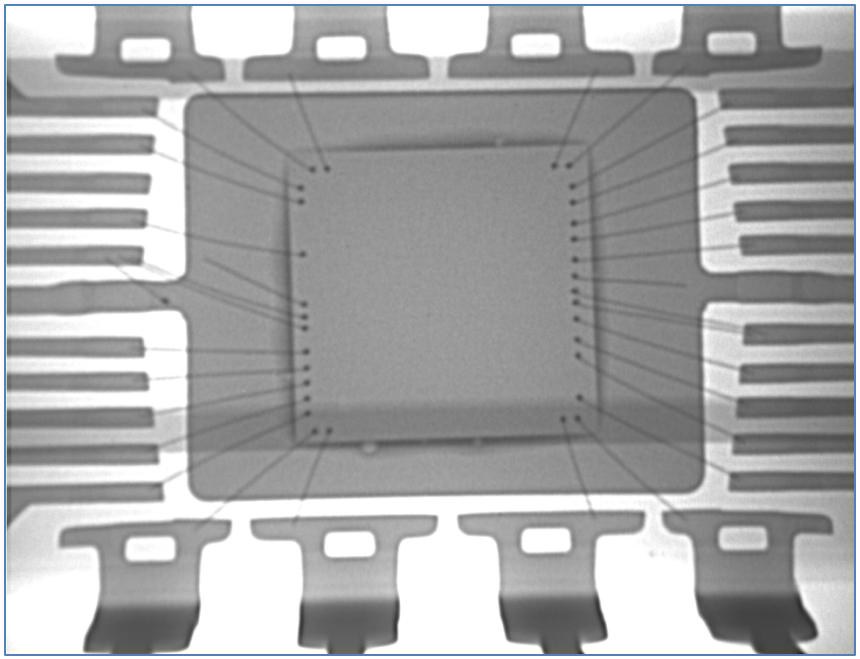
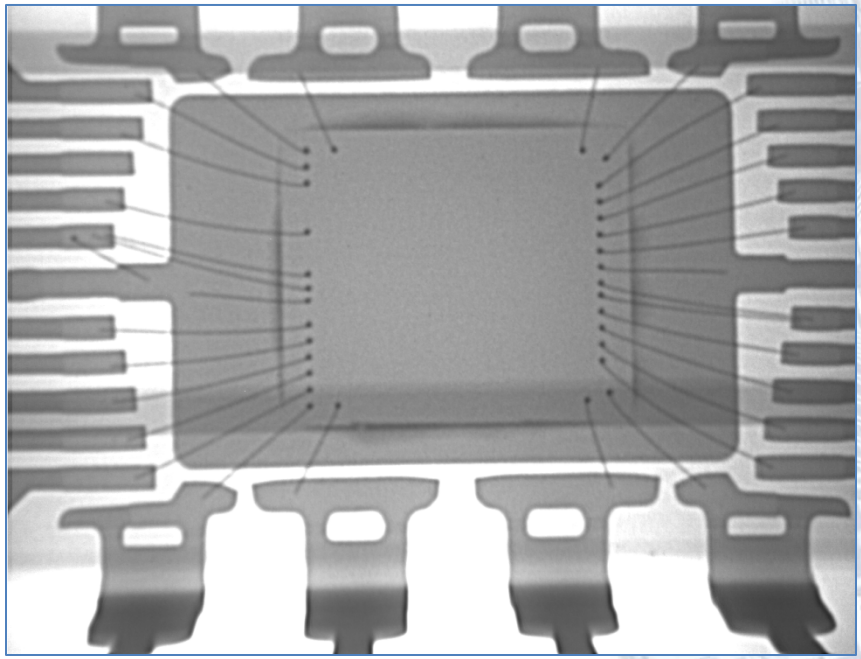
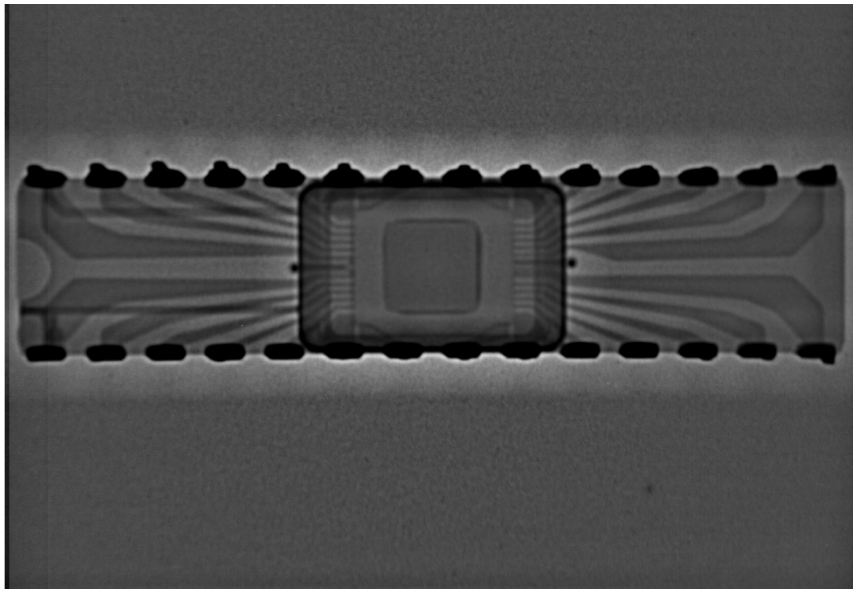
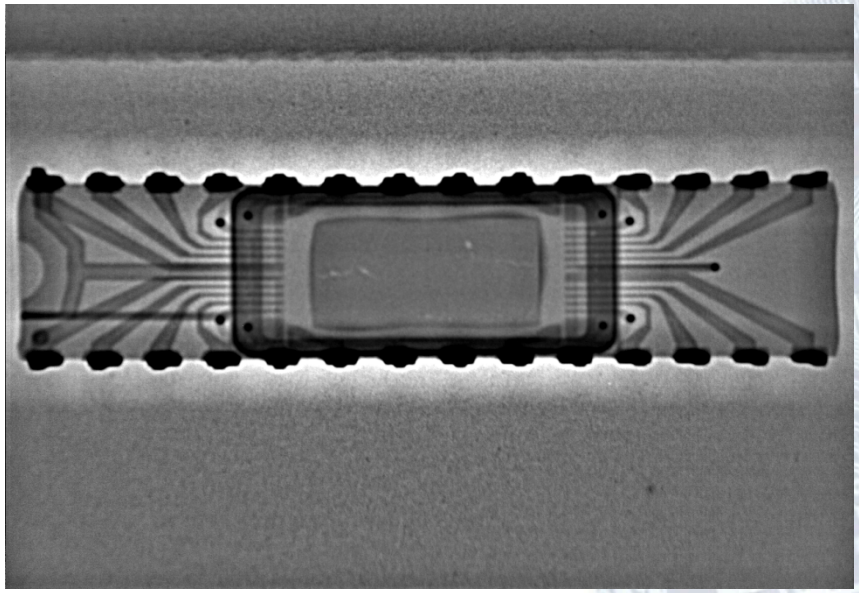


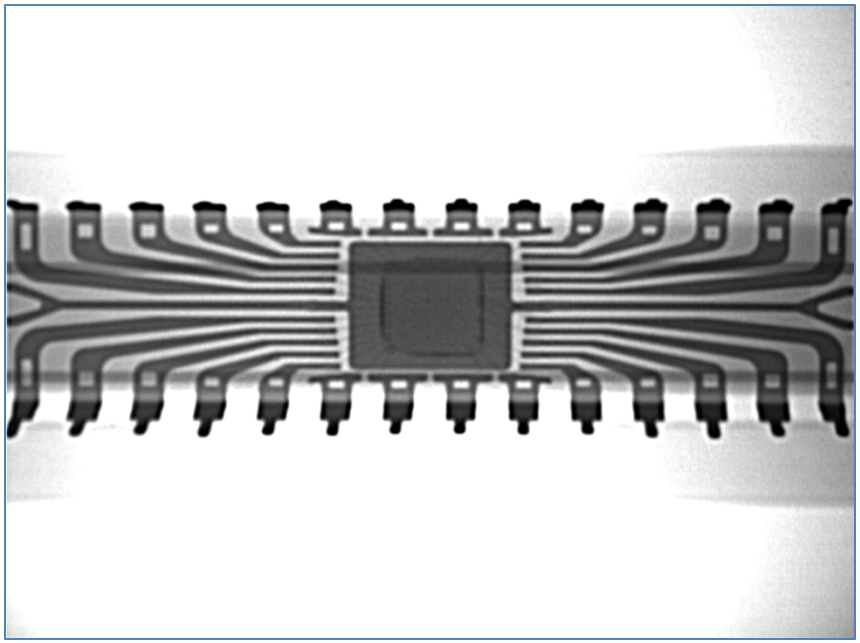


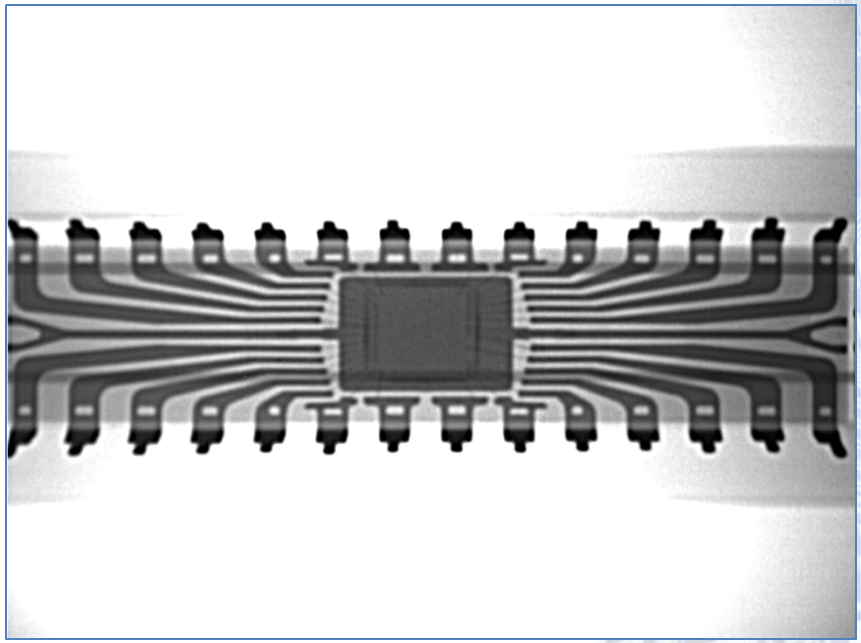
- Die size differences
- Wire bond differences
- Trace shape differences



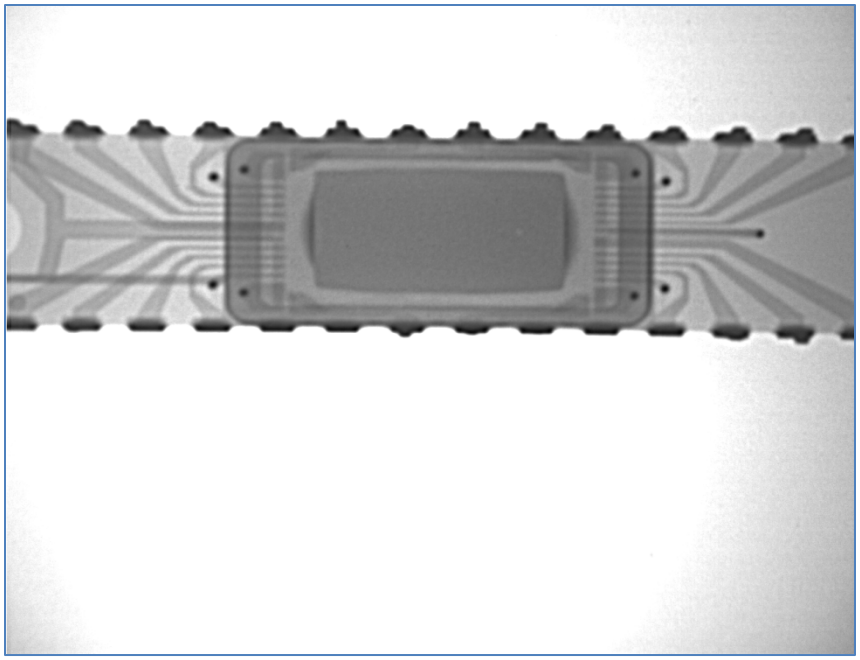


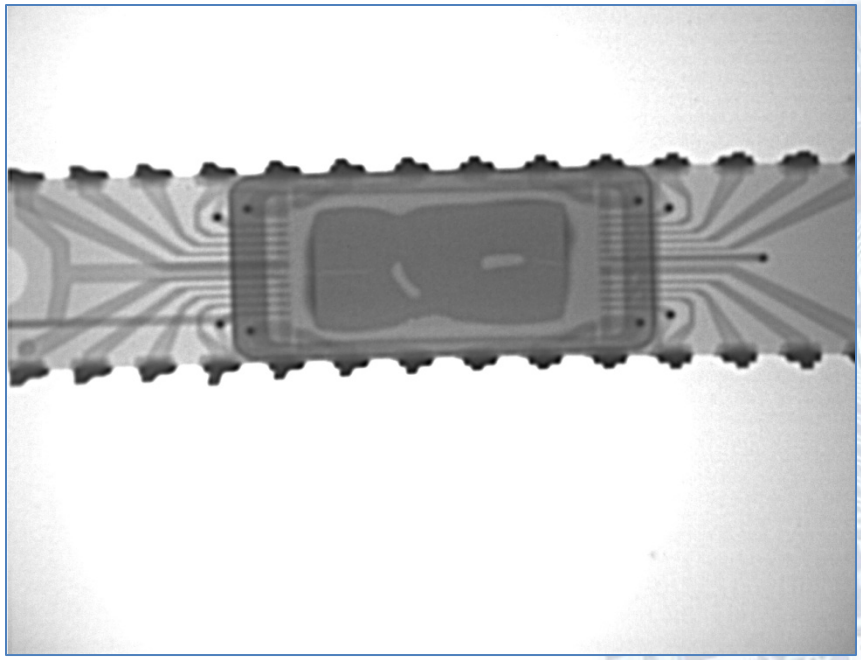
- Received one “Known Good” part for comparison
- Visually identical on external examination
- Internal trace differences
- Internal die differences





- Die shape differences
- Trace shape differences
- Wire bond differences



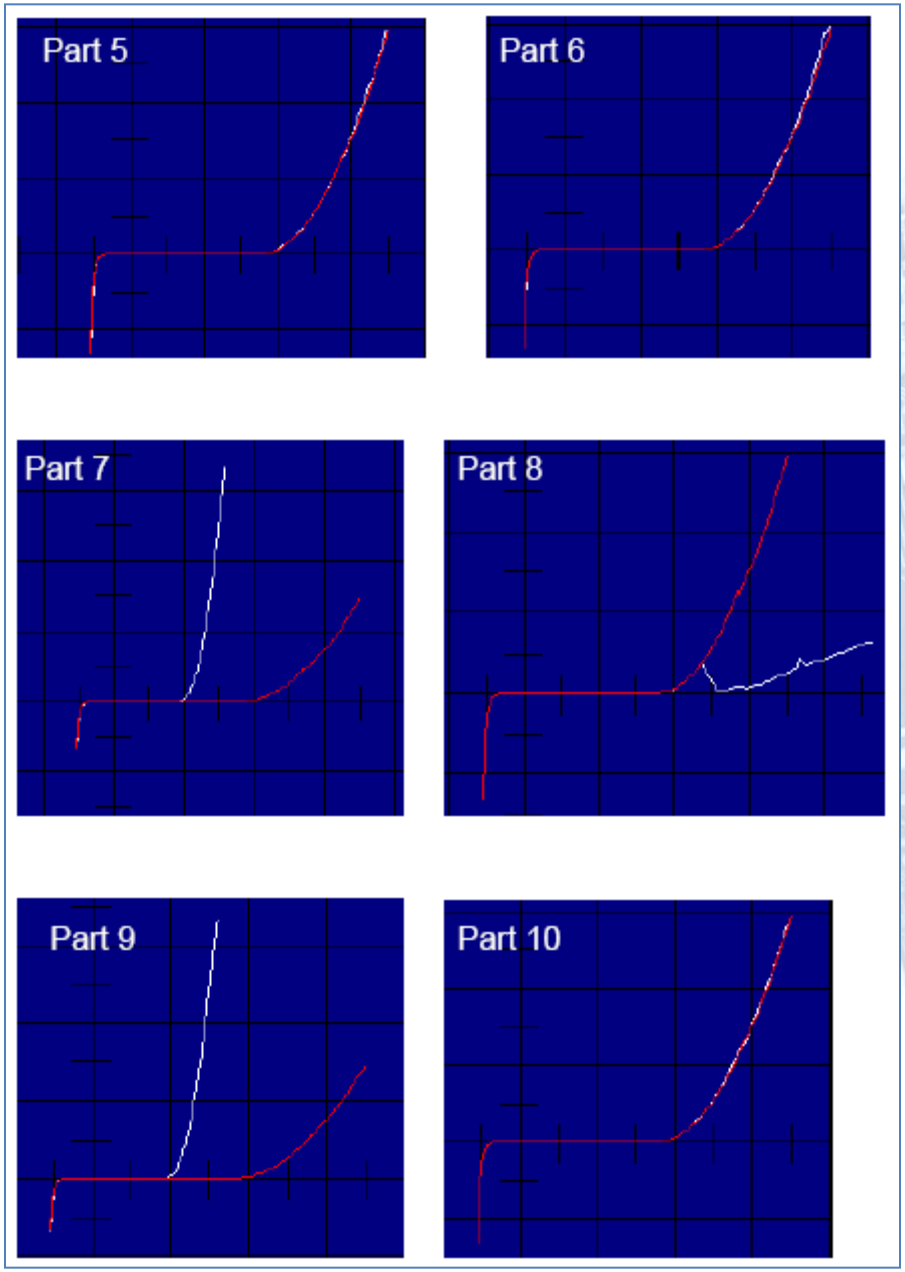


Die defects

Electrical

- Compare
- Curve Trace
- Resistance
- Capacitance
- Continuity
- Inductance
- Pin to Pin Isolation

- I-V traces obtained from V_{cc} against V_{ss}
- Red curve is reference obtained from Part 1
- Parts 7, 8 and 9 do not correlate with reference curve
- Parts 5, 6 and 10 are representative of parts which do correlate with reference curve



SERIES 1008R 1008

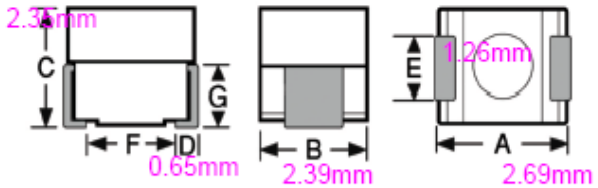
RoHS Compliant

Traditional First Quality

Shielded Surface Mount Inductors

RF Inductors

Actual Size



Physical Parameters

	Inches	Millimeters
A	0.095 to 0.115	2.41 to 2.92
B	0.085 to 0.105	2.16 to 2.66
C	0.075 to 0.095	1.91 to 2.41
D	0.010 to 0.030	0.26 to 0.76
E	0.040 to 0.060	1.02 to 1.52
F	0.060 (Ref. only)	1.52 (Ref. only)
G	0.045 (Ref. only)	1.14 (Ref. only)

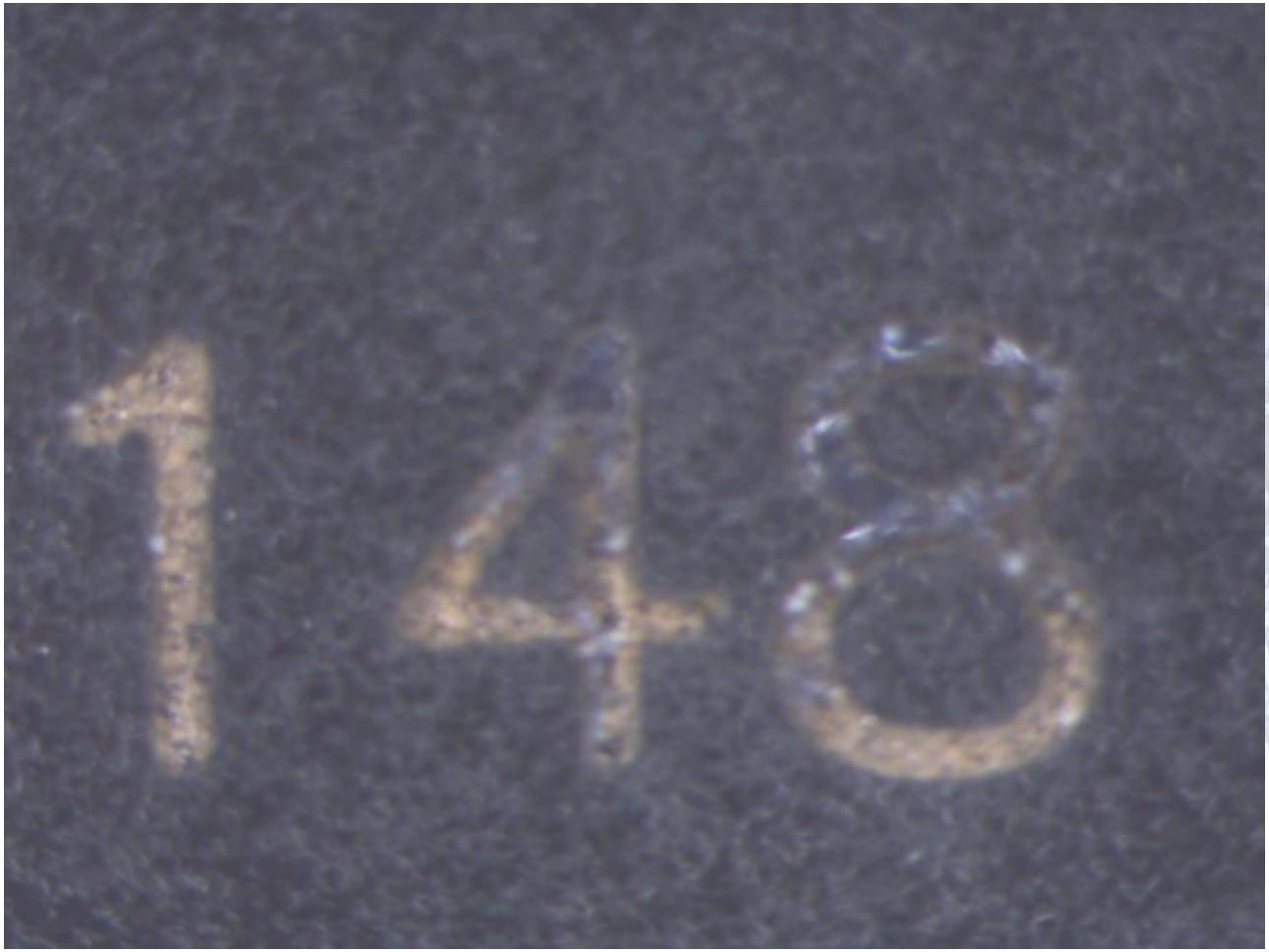
Dimensions "A" and "C" are over terminals.

DASH NUMBER*	INDUCTANCE (µH)	TOLERANCE	Q MINIMUM	TEST FREQUENCY (MHz)	SRF MINIMUM (MHz)	DC RESISTANCE MAXIMUM (OHMS)	CURRENT RATING MAXIMUM (mA)
SERIES 1008 PHENOLIC CORE							
-018M	0.0018	±20%	40	50	2700	0.050	1562
-022M	0.0022	±20%	40	50	2700	0.050	1562
-027M	0.0027	±20%	40	50	2700	0.050	1562
-033M	0.0033	±20%	40	50	2700	0.050	1562
-039M	0.0039	±20%	40	50	2700	0.050	1562
-047M	0.0047	±20%	40	50	2700	0.050	1562
-056M	0.0056	±20%	40	50	2700	0.050	1562
-068M	0.0068	±20%	40	50	2700	0.050	1562
-082M	0.0082	±20%	40	50	2700	0.050	1562
-100K	0.010	±10%	40	50	2700	0.050	1562
-120K	0.012	±10%	40	50	2450	0.058	1450
-150K	0.015	±10%	40	50	2200	0.064	1381
-180K	0.018	±10%	40	50	2000	0.070	1320
-220K	0.022	±10%	35	50	1800	0.080	1235
-270K	0.027	±10%	35	50	1625	0.090	1164
-330K	0.033	±10%	30	50	1450	0.100	1105
-390K	0.039	±10%	30	50	1335	0.110	1053
-470K	0.047	±10%	30	50	1220	0.120	1008
-560K	0.056	±10%	25	50	1110	0.170	847
-680K	0.068	±10%	25	50	1000	0.180	823
-820K	0.082	±10%	25	50	915	0.190	801
-101K	0.100	±10%	15	25	550	0.230	728
SERIES 1008 FERRITE CORE							
-121K	0.12	±10%	40	25	750	0.100	1225
-151K	0.15	±10%	40	25	650	0.110	1168
-181K	0.18	±10%	40	25	550	0.120	1119
-221K	0.22	±10%	40	25	450	0.135	1055
-271K	0.27	±10%	40	25	375	0.150	1000
-331K	0.33	±10%	40	25	300	0.165	954
-391K	0.39	±10%	40	25	250	0.180	913
-471K	0.47	±10%	40	25	215	0.210	846
-561K	0.56	±10%	40	25	195	0.230	808
-681K	0.68	±10%	40	25	175	0.260	760

Re-marking

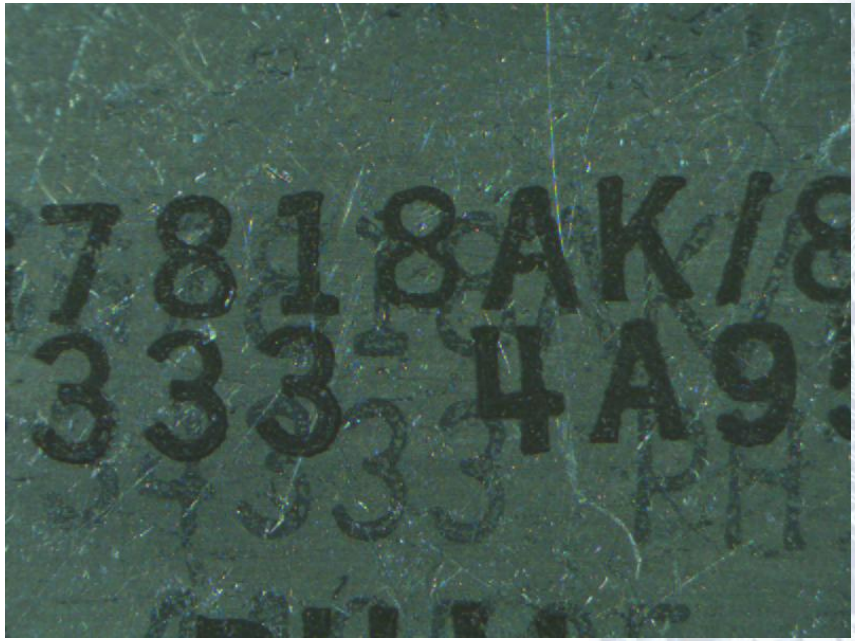
- Solvents
  - Mineral Spirits/Rubbing Alcohol Mixture
  - Acetone
- Cotton swab
- Examine for:
  - Permanency
    - Ink
    - Laser etched
  - Previous markings

Marking permanency



Faded marking

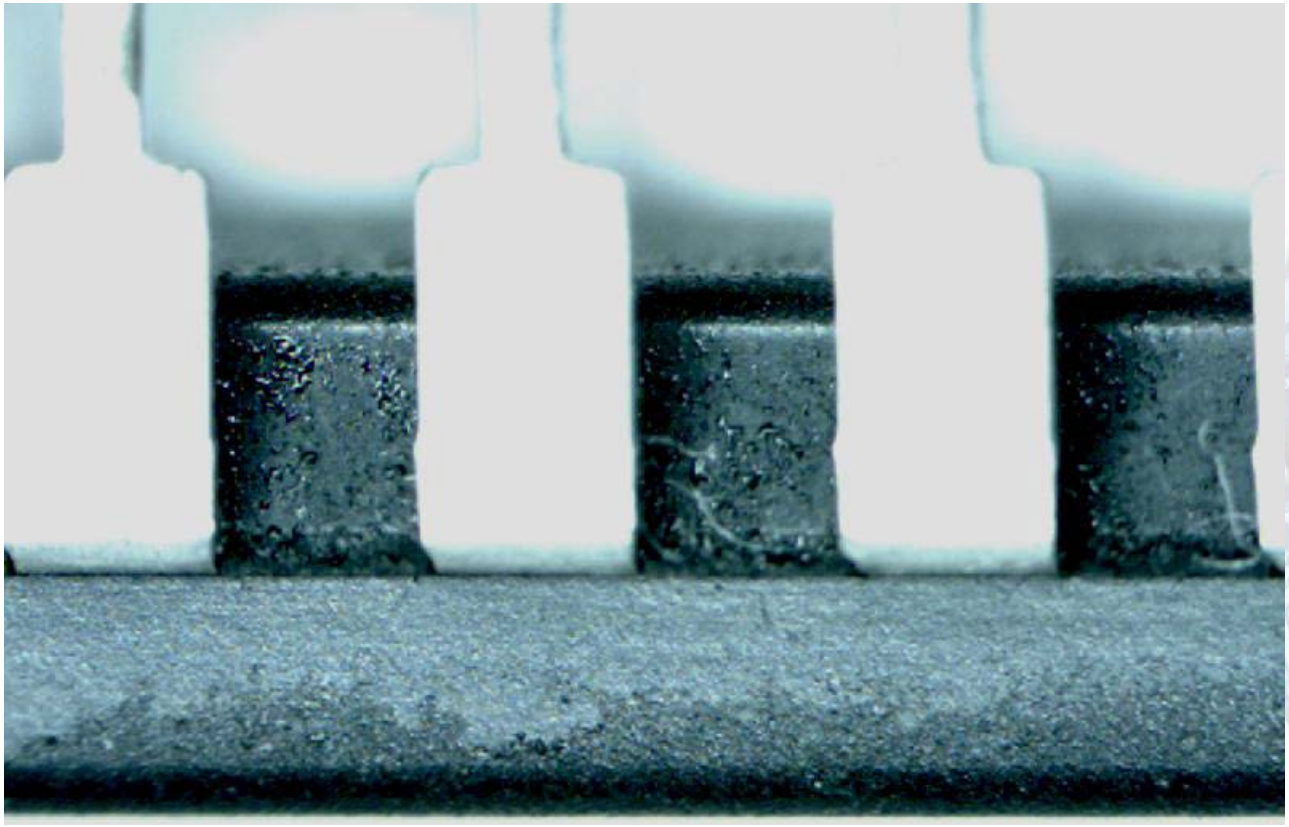
Two parts received in same lot



Remarked component - Different fonts

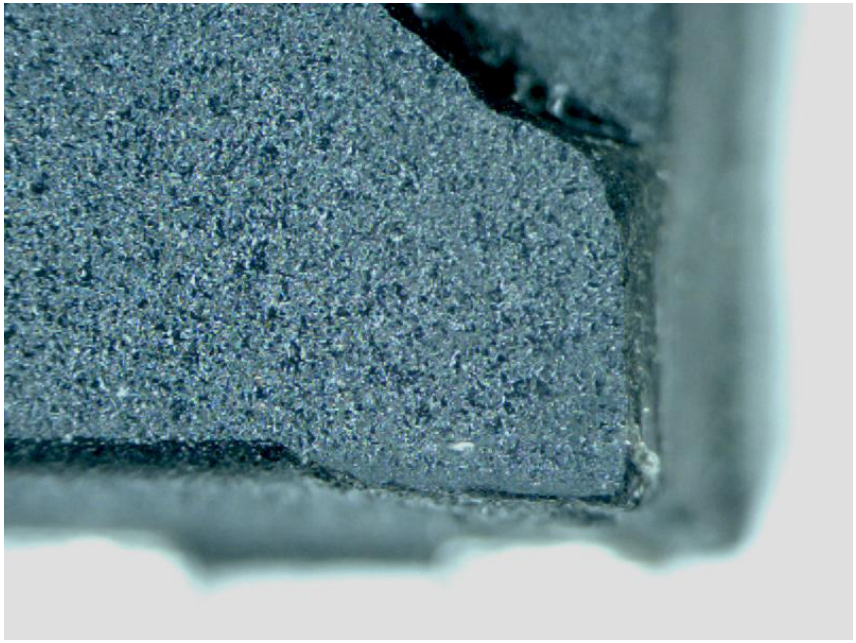
Re-surfacing

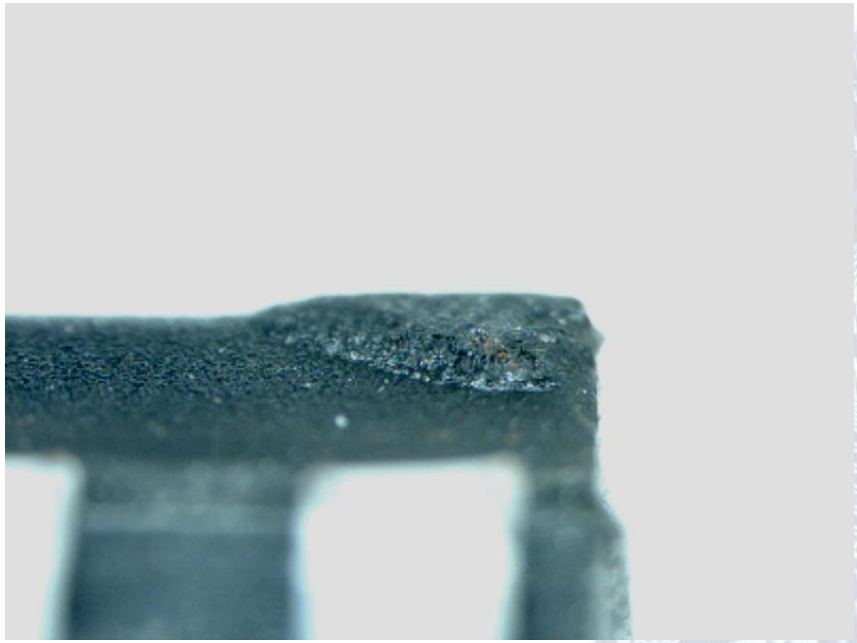
- Solvents - heated
  - NMP
  - Dynasolve
  - Uresolve
- Can material be removed?
- Examine for:
  - sanding marks
  - prior marking



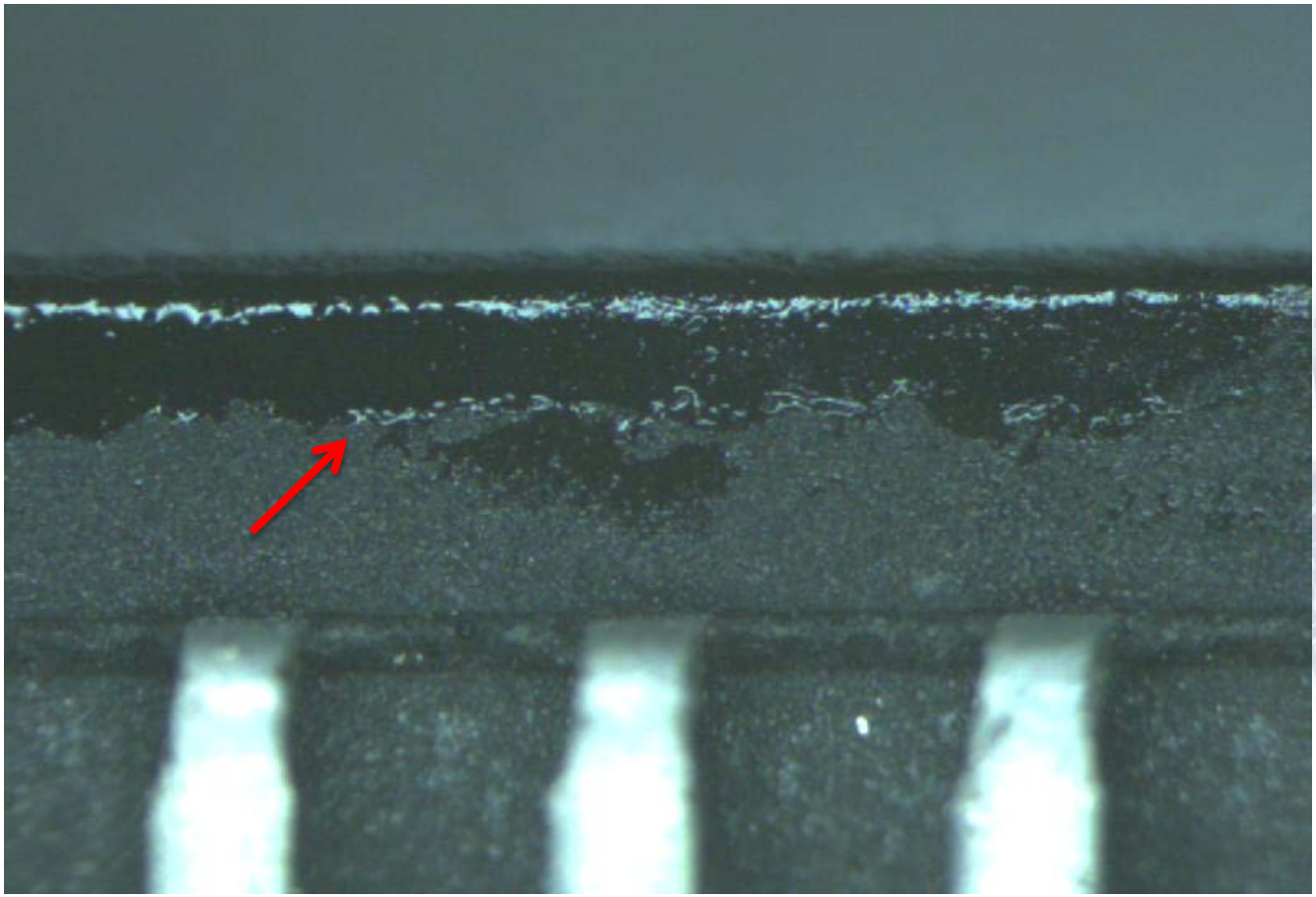
Resurfacing material present between leads

Excess resurfacing material on smooth center

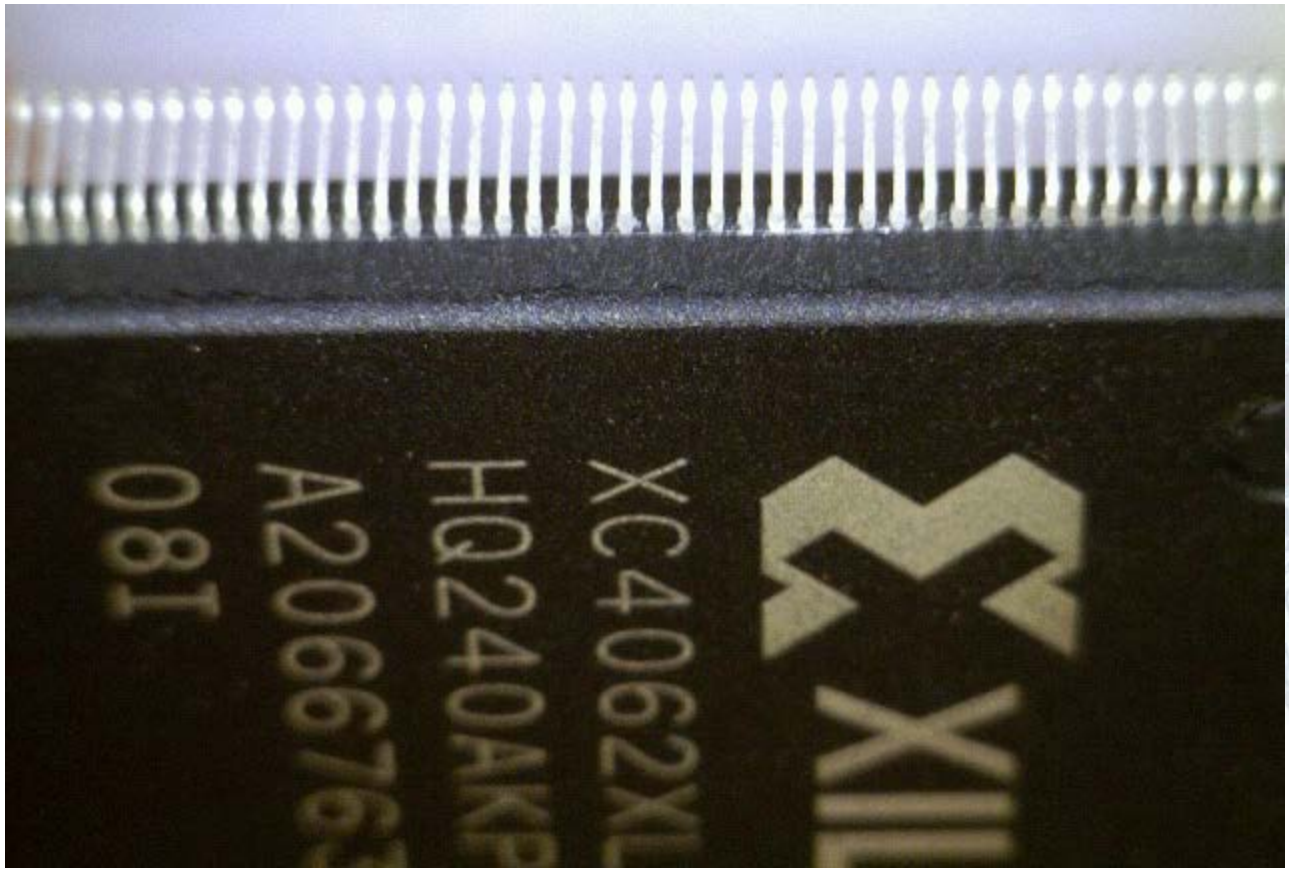




- Excess resurfacing material
- Overhangs edge
- Changes corner radius



Resurfacing drip line



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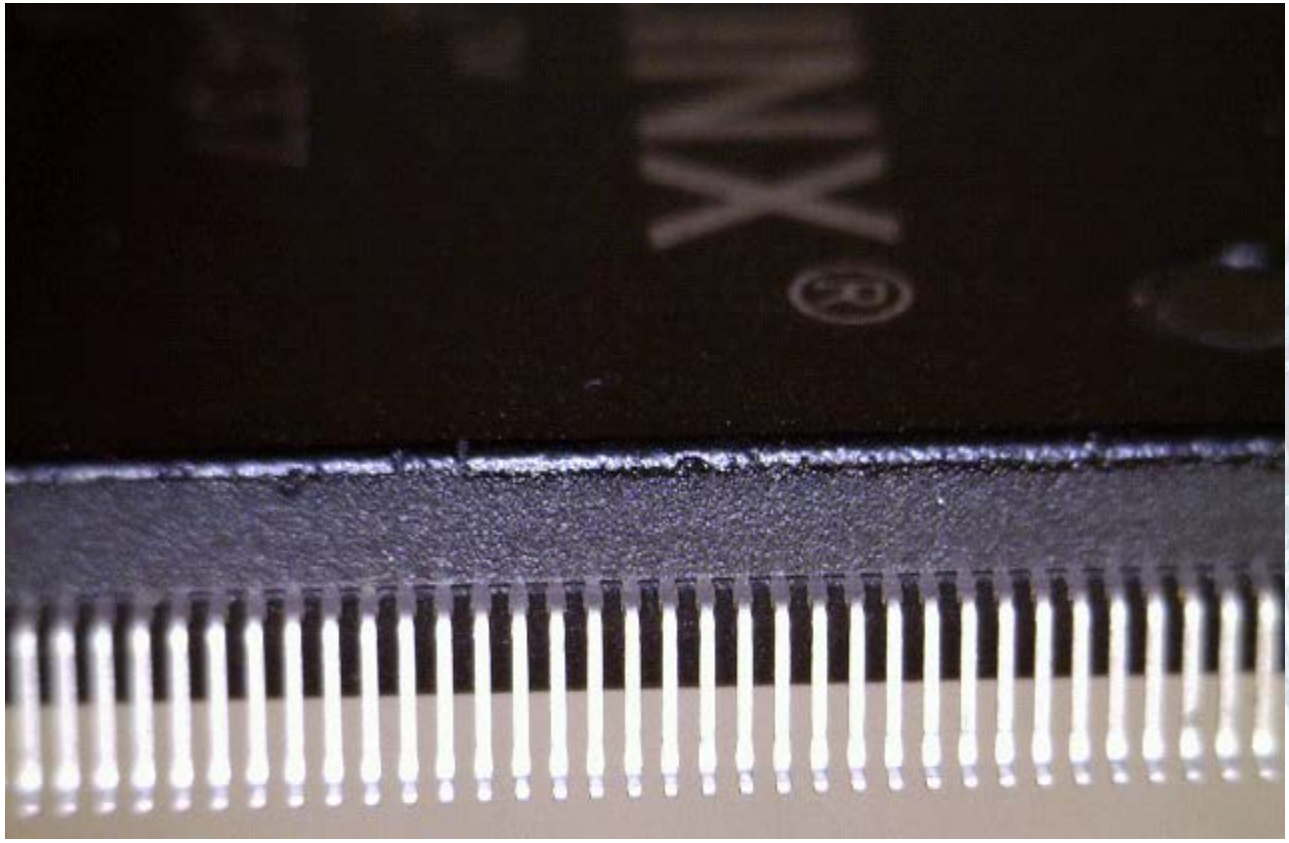

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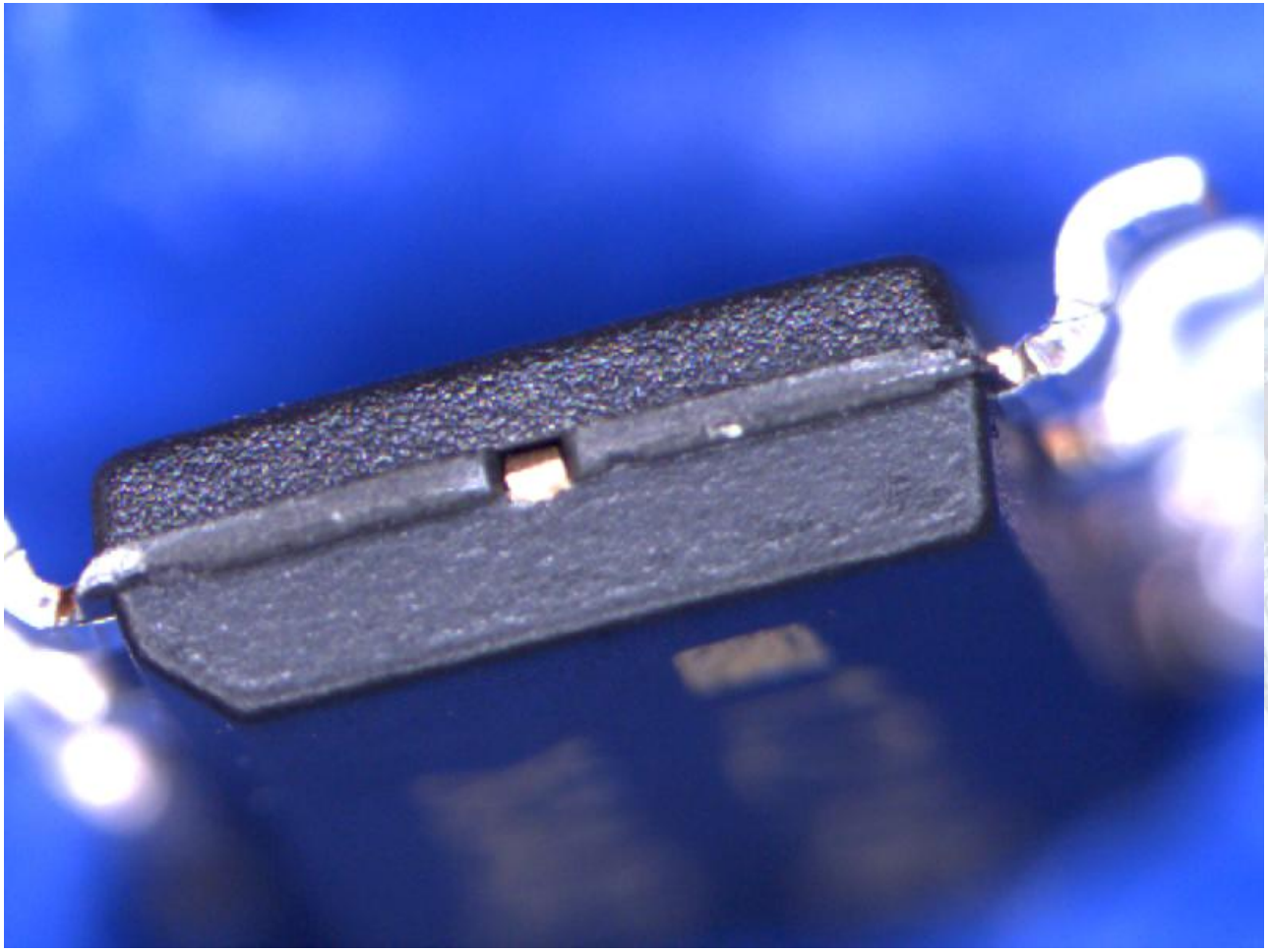
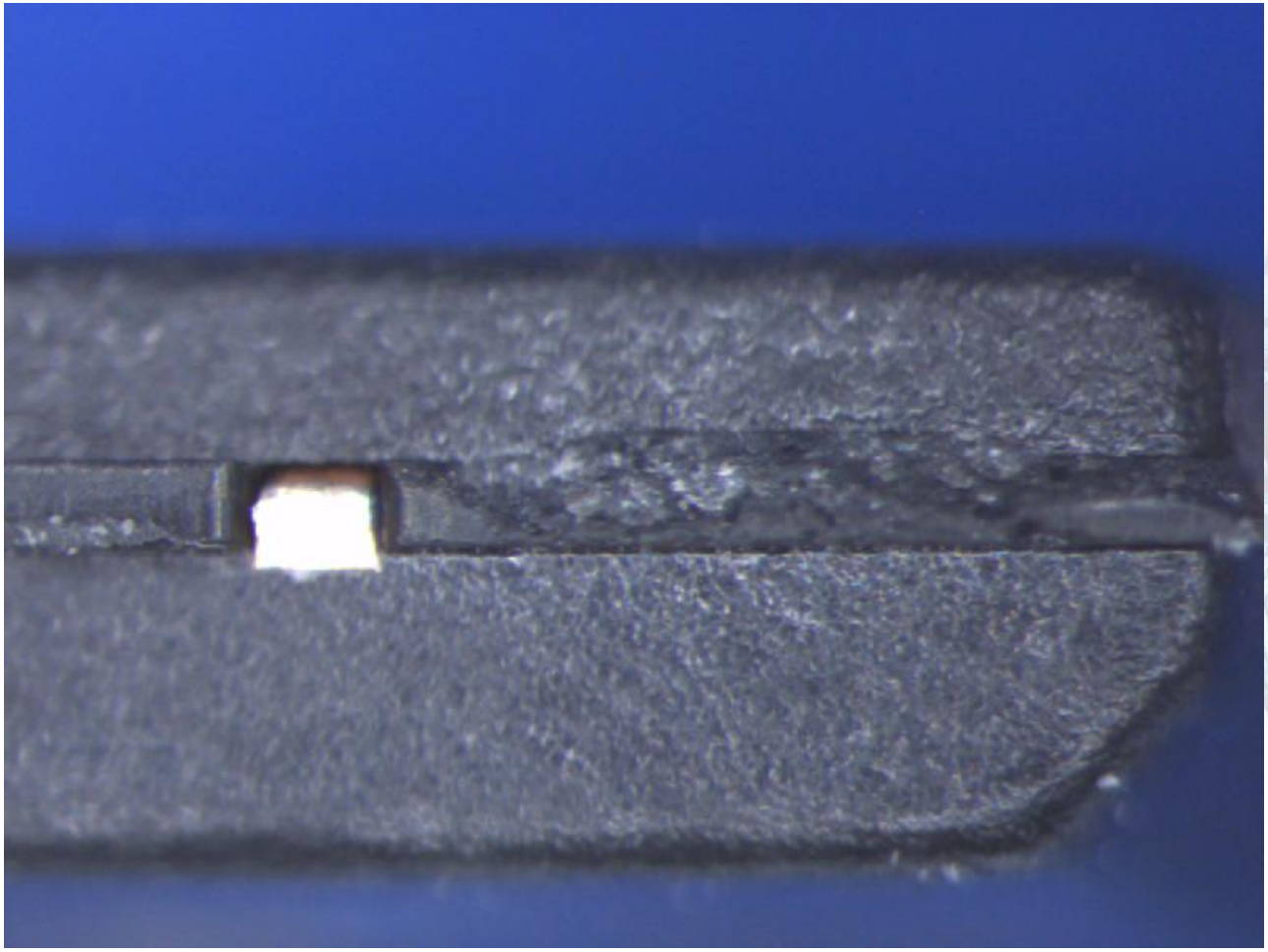
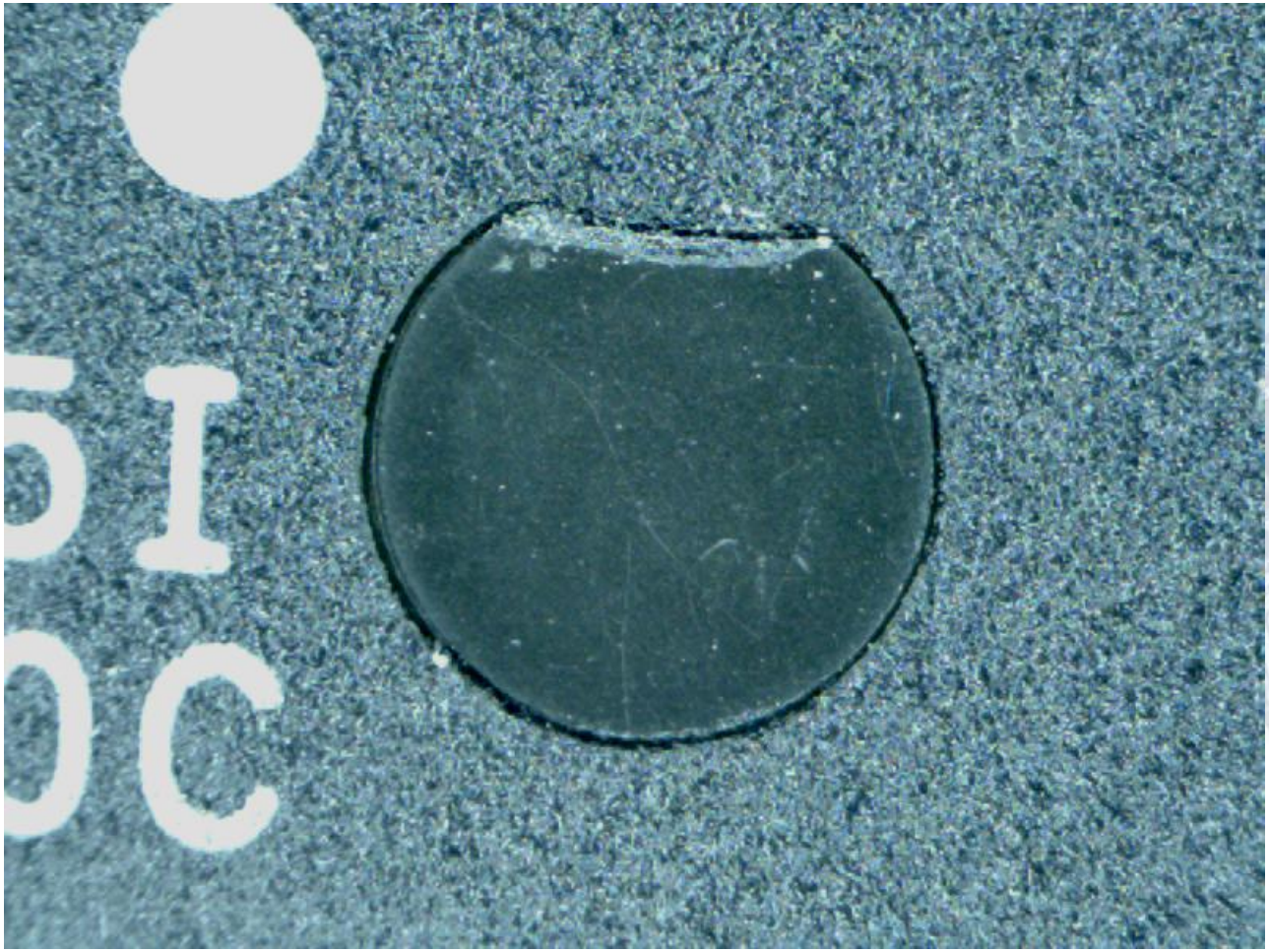


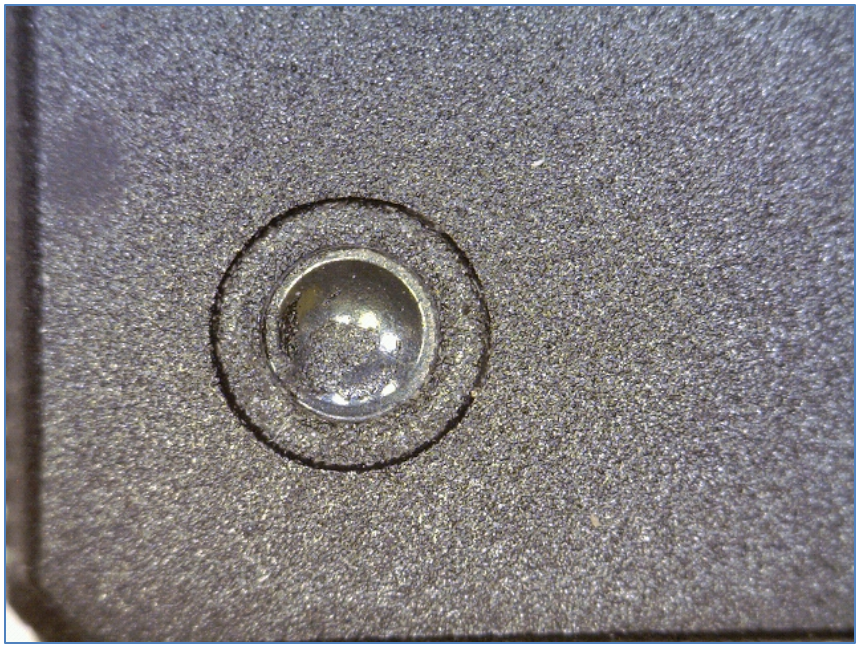
Texture differences between top and bottom of the part

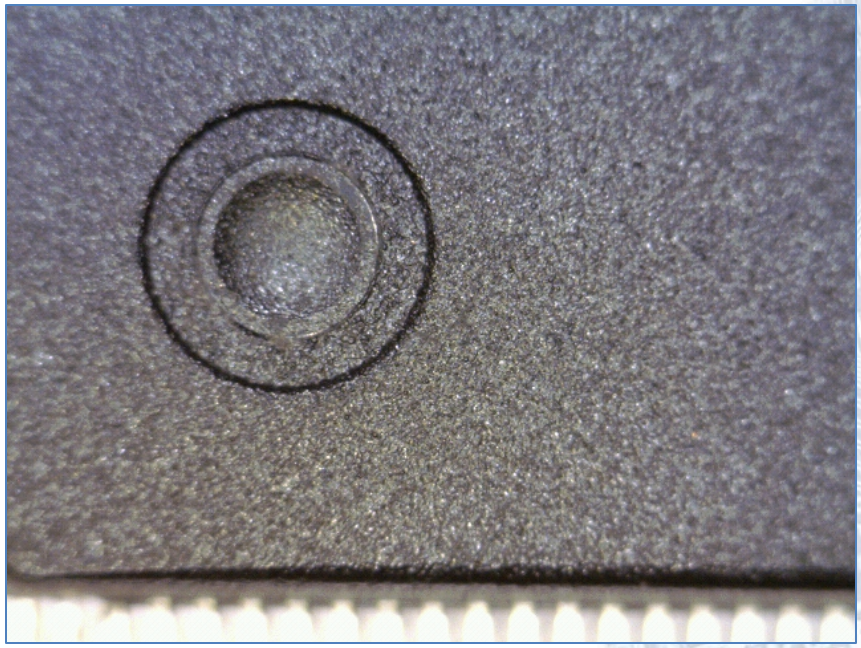


Excess resurfacing material

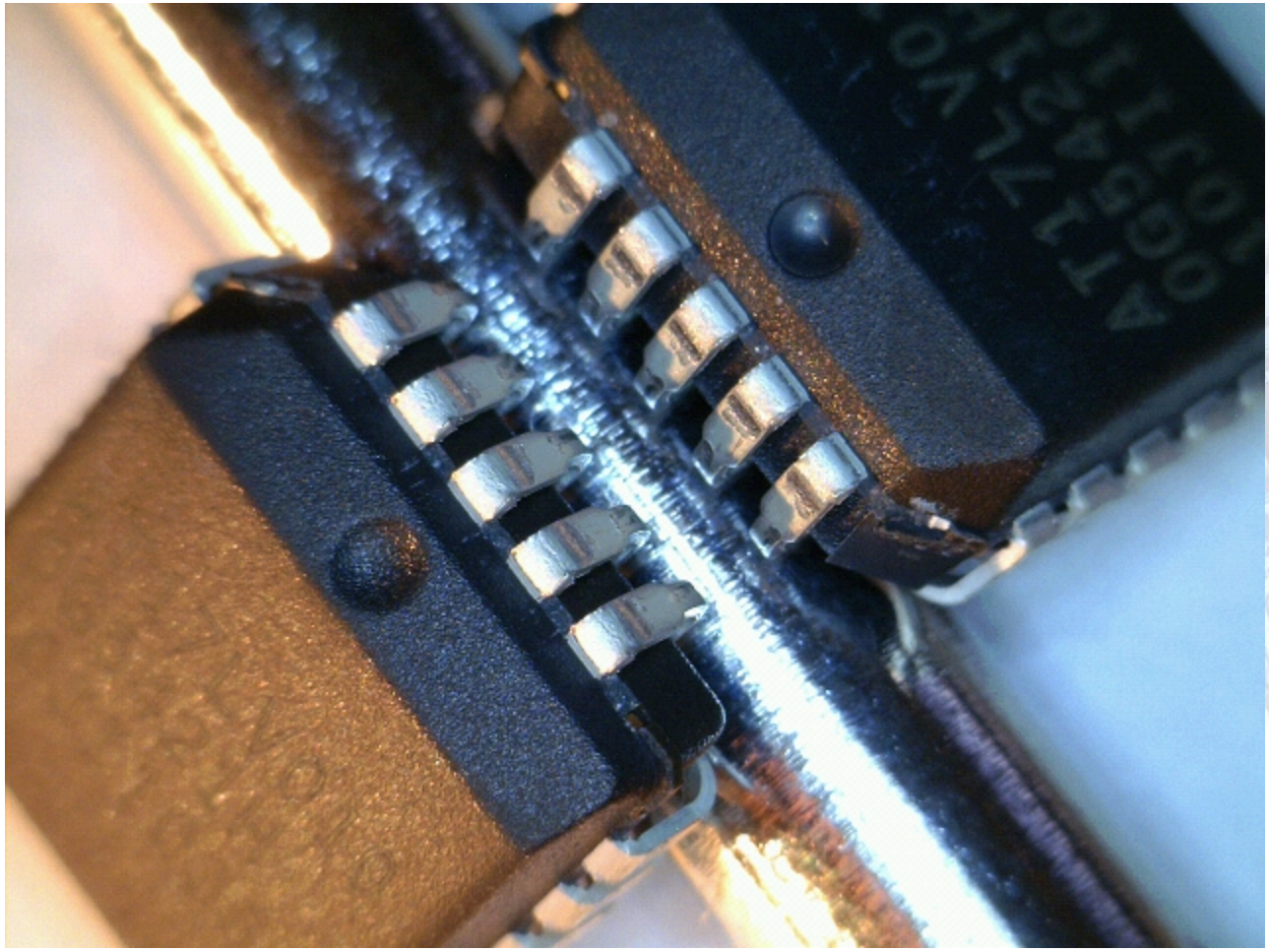


Excess resurfacing material within mold cavity

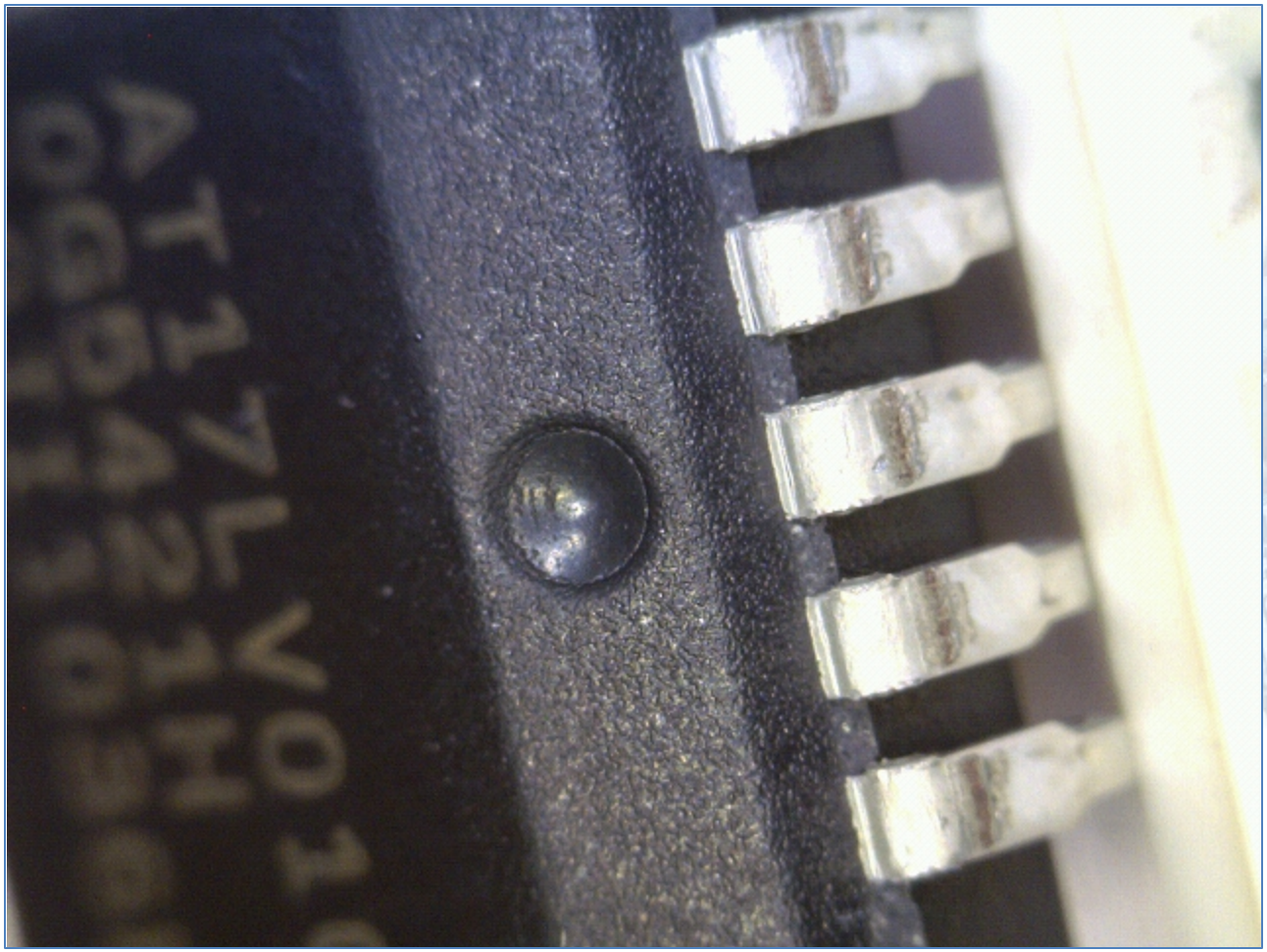




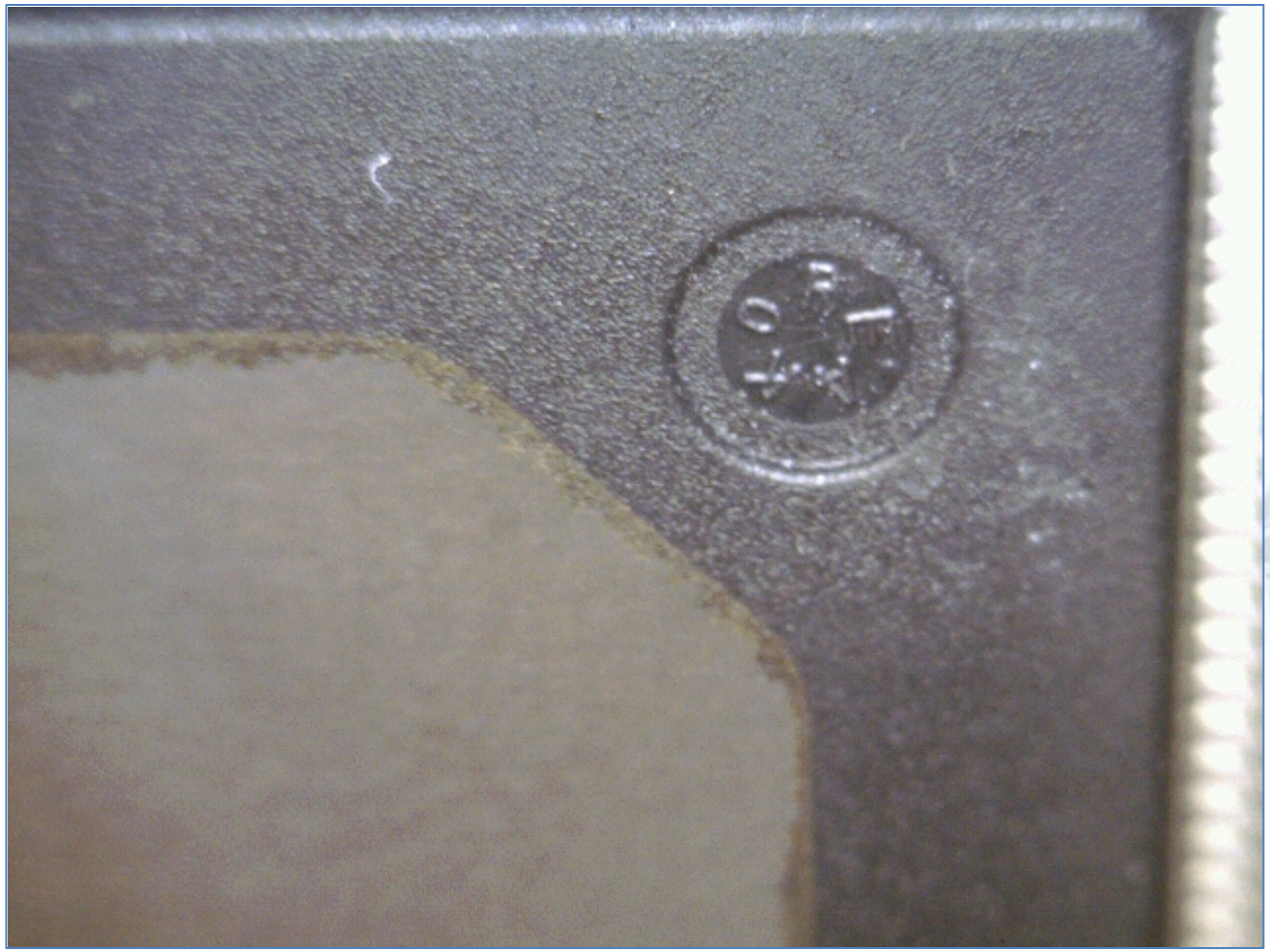
Mold cavity differences within same lot



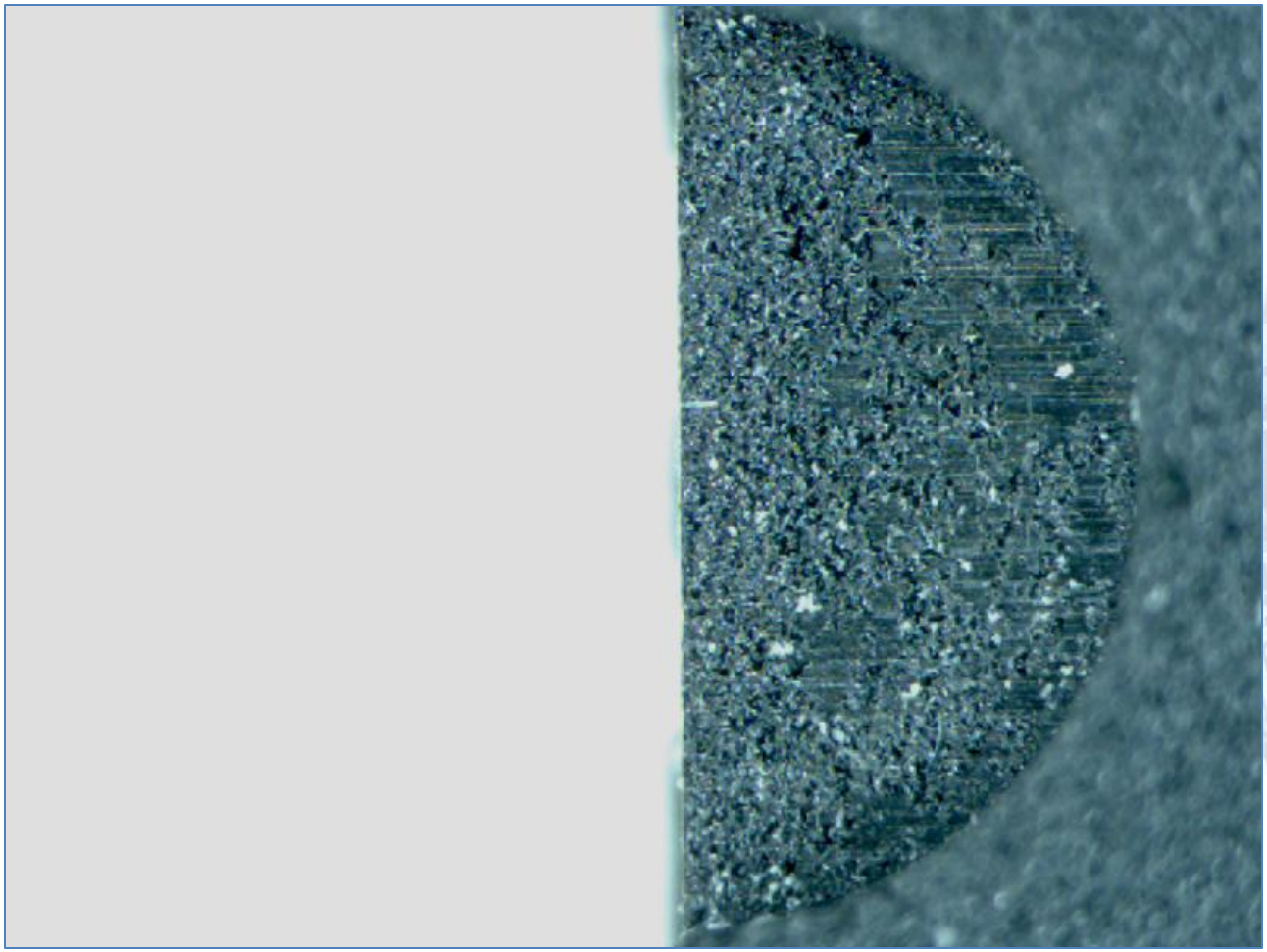
Mold cavity differences within same lot



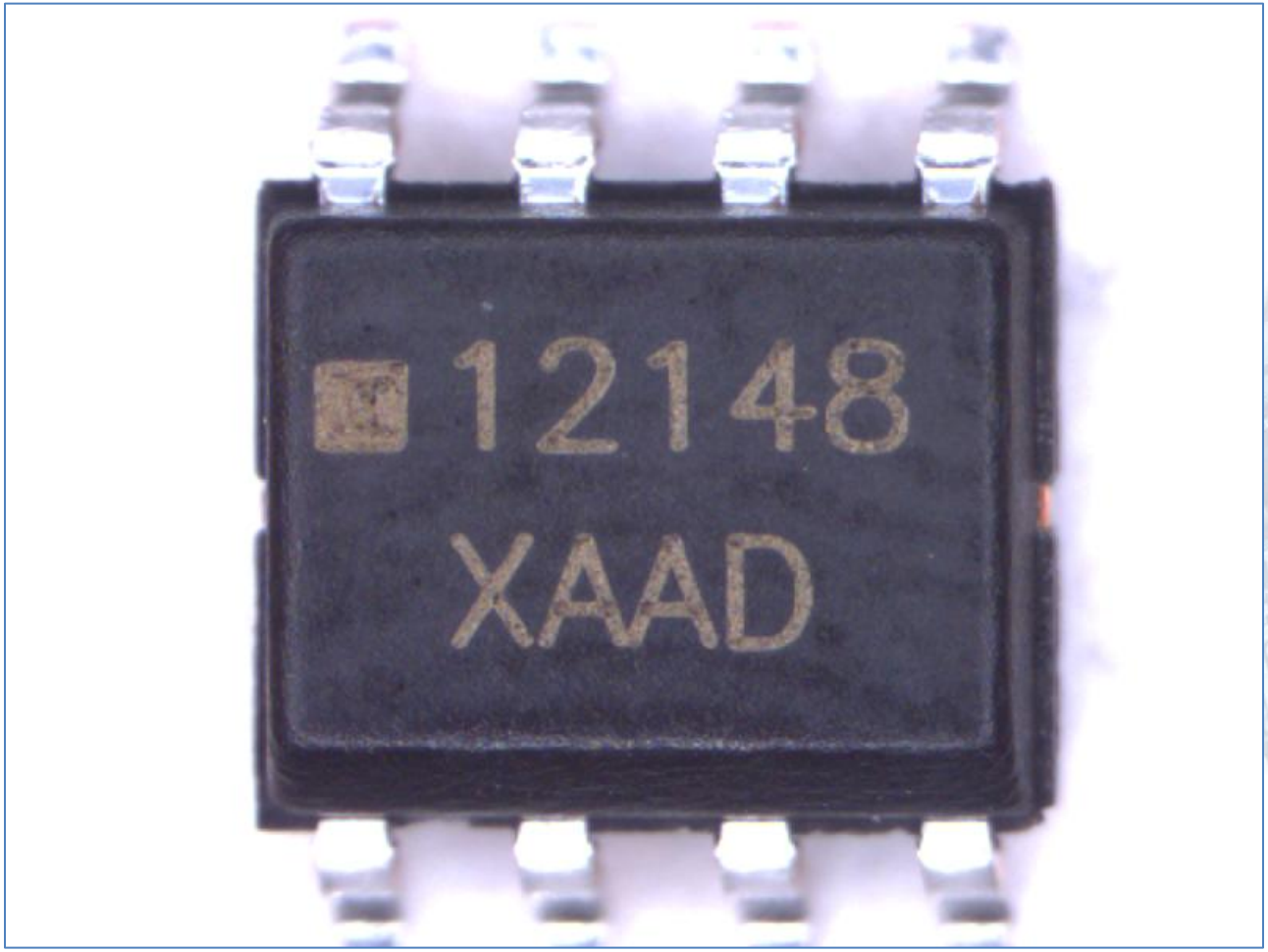
Excess resurfacing material in mold cavity



Inconsistent edge of resurfacing material



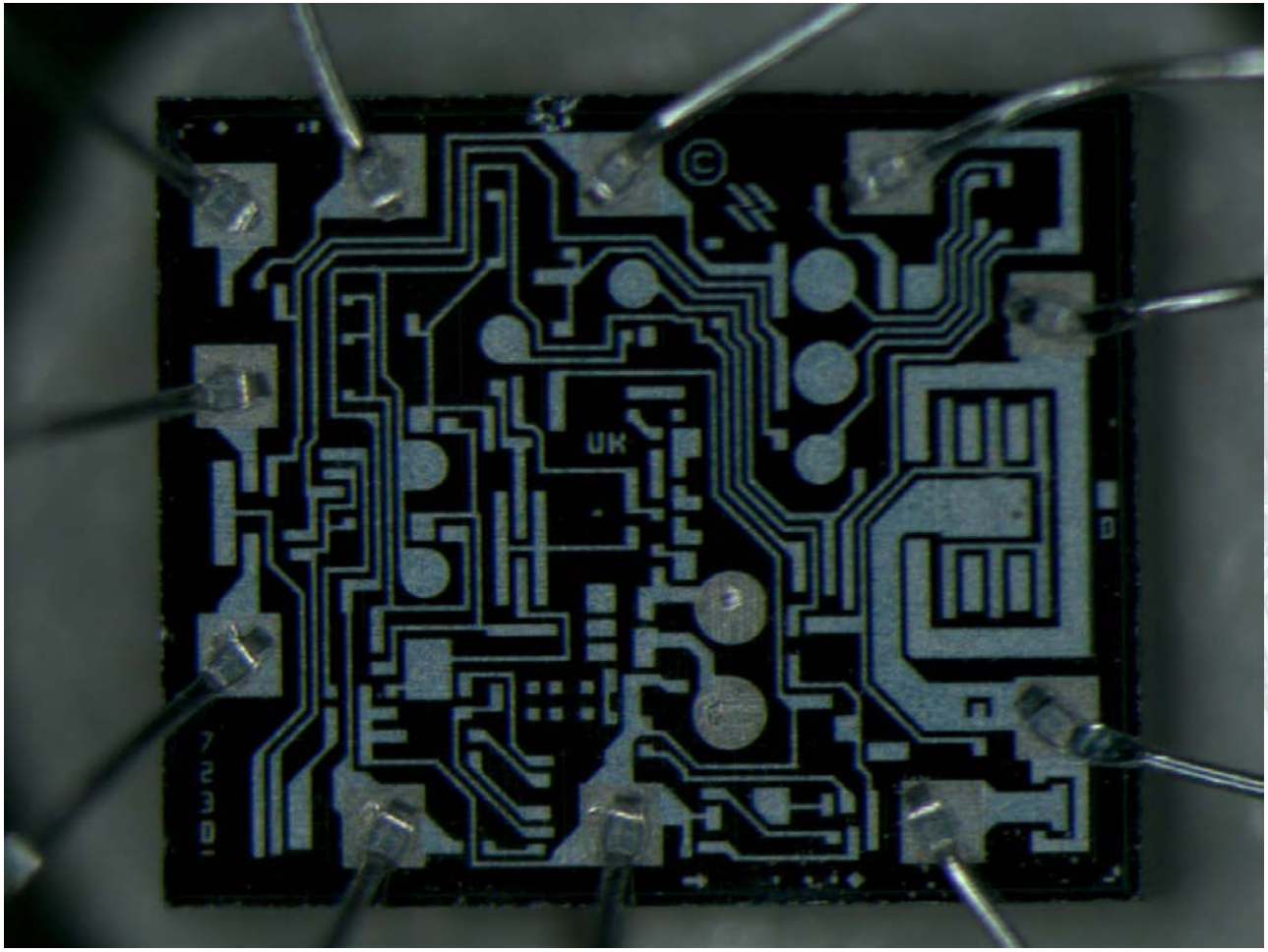
Sanding marks and resurfacing material in notch



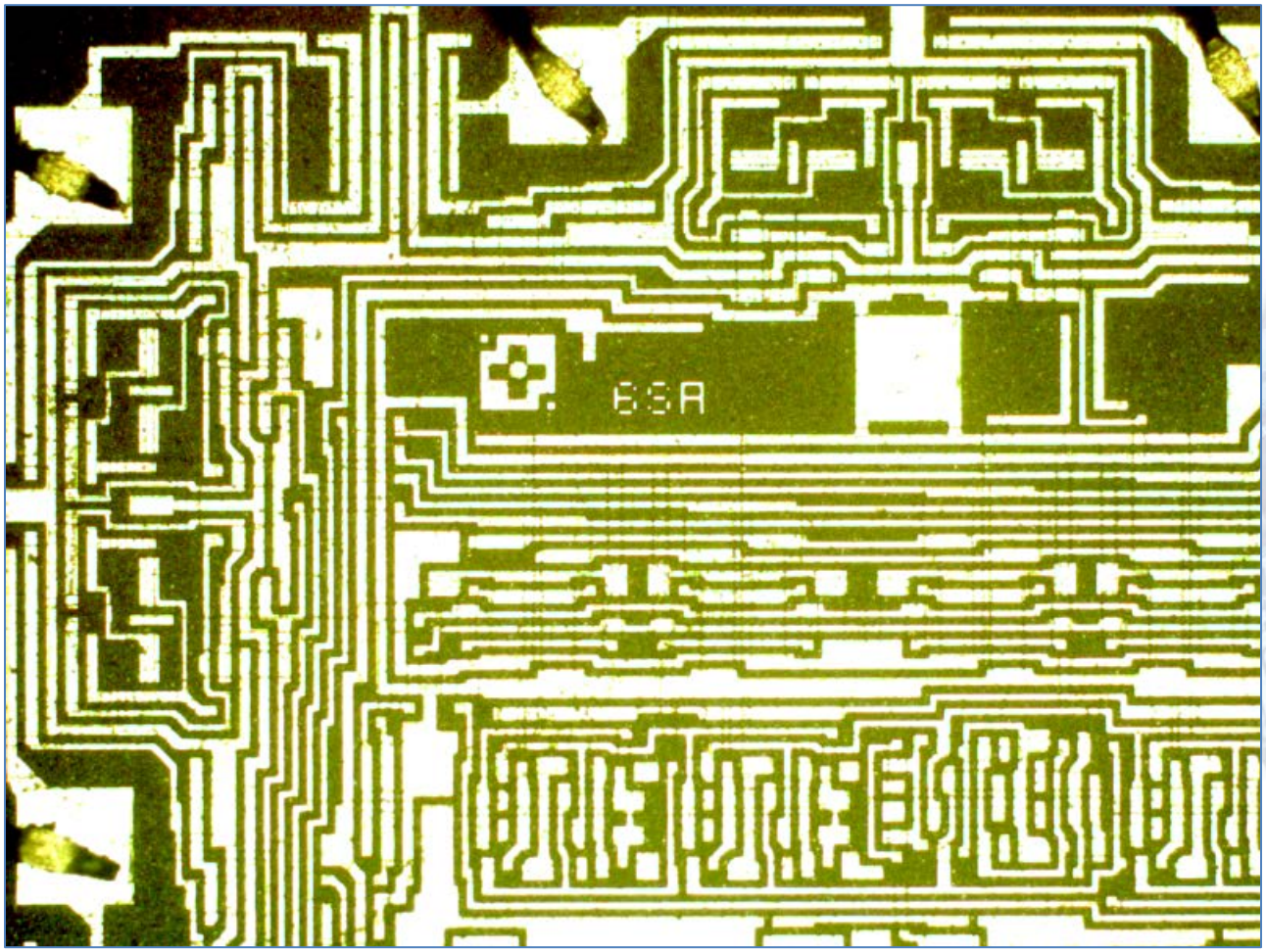
Surface streaking

Decapsulation

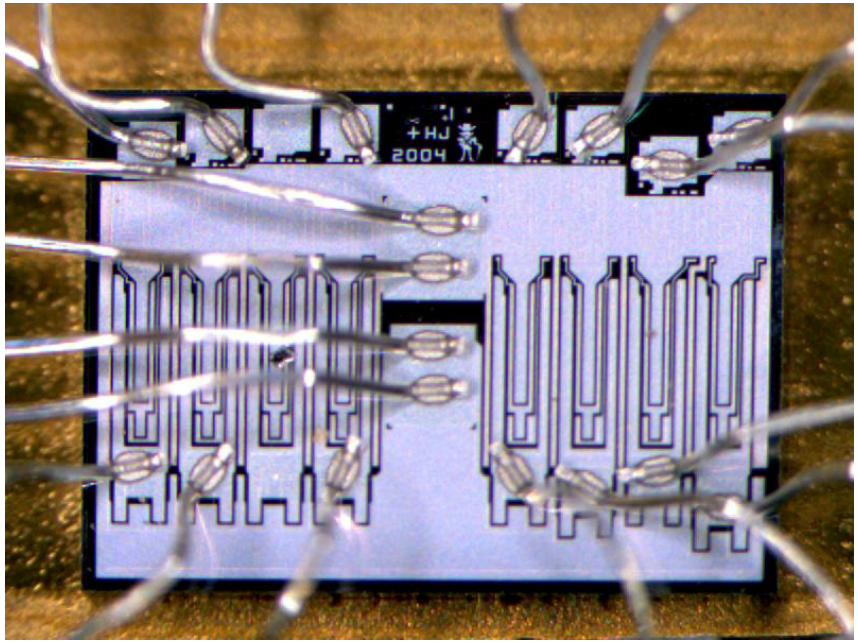
- Removal of encapsulant material using:
  - Heat
  - Acid mixture
- Examine:
  - Internal wire bonds
  - Die markings
  - Die defects

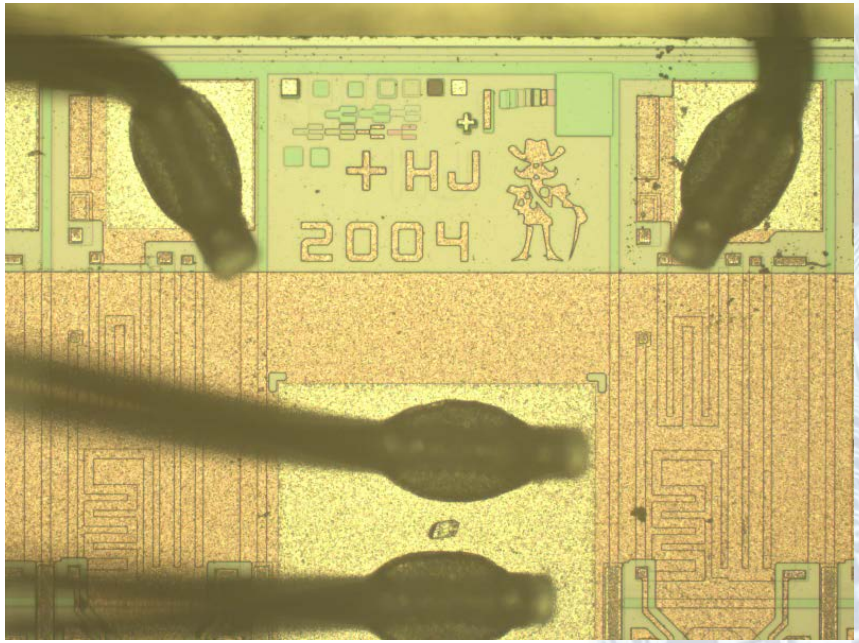


Internal die after decapsulation



Examine traces, wire bonds, markings

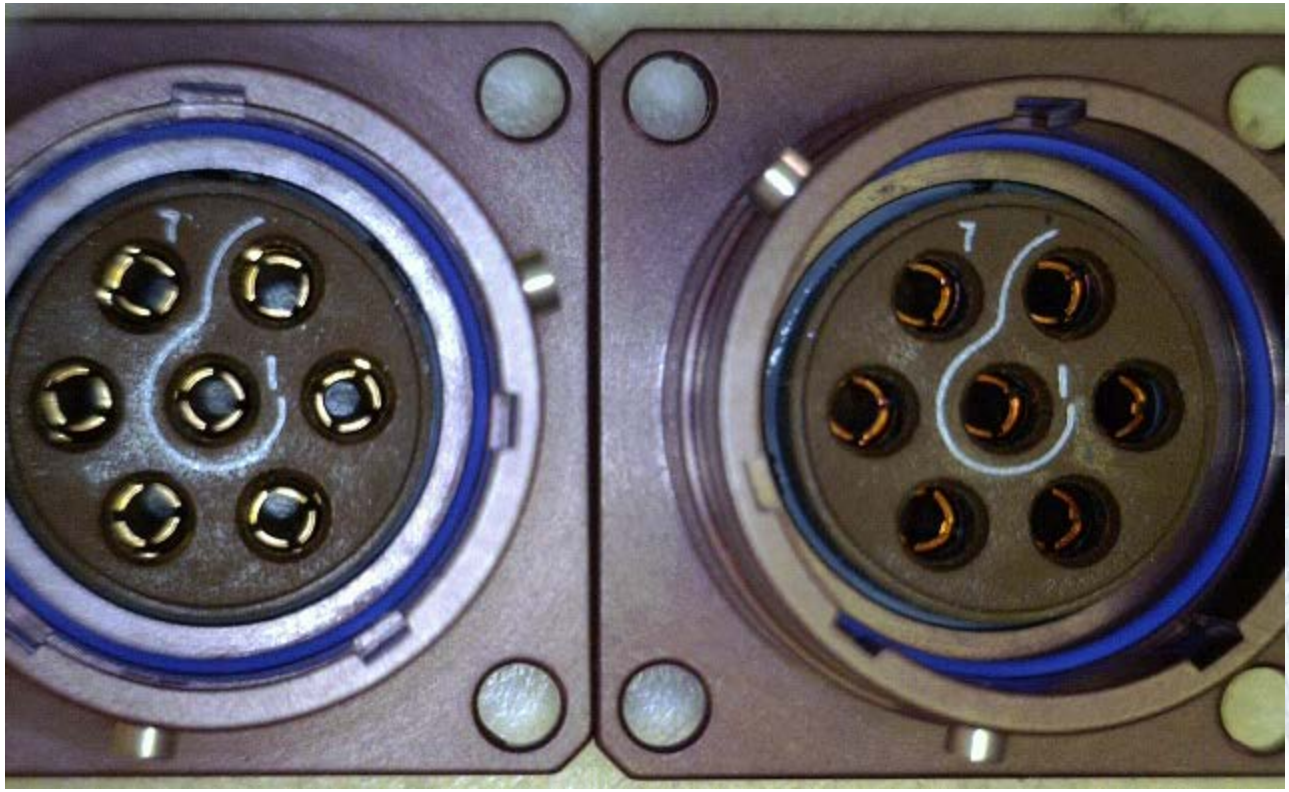




Different magnifications and light sources

Lead Composition

- XRF and/or SEM-EDS
- Verify against datasheet
- Plating composition
  - Pb
  - Pb-free
- Plating thickness
- Barrier metals



Plating differences

Who has the first question?

- **LaShawnda Scott**
- **Trace Laboratories**
- **Hunt Valley MD**
- **410.584.4392**
- **lscott@tracelabs.com**