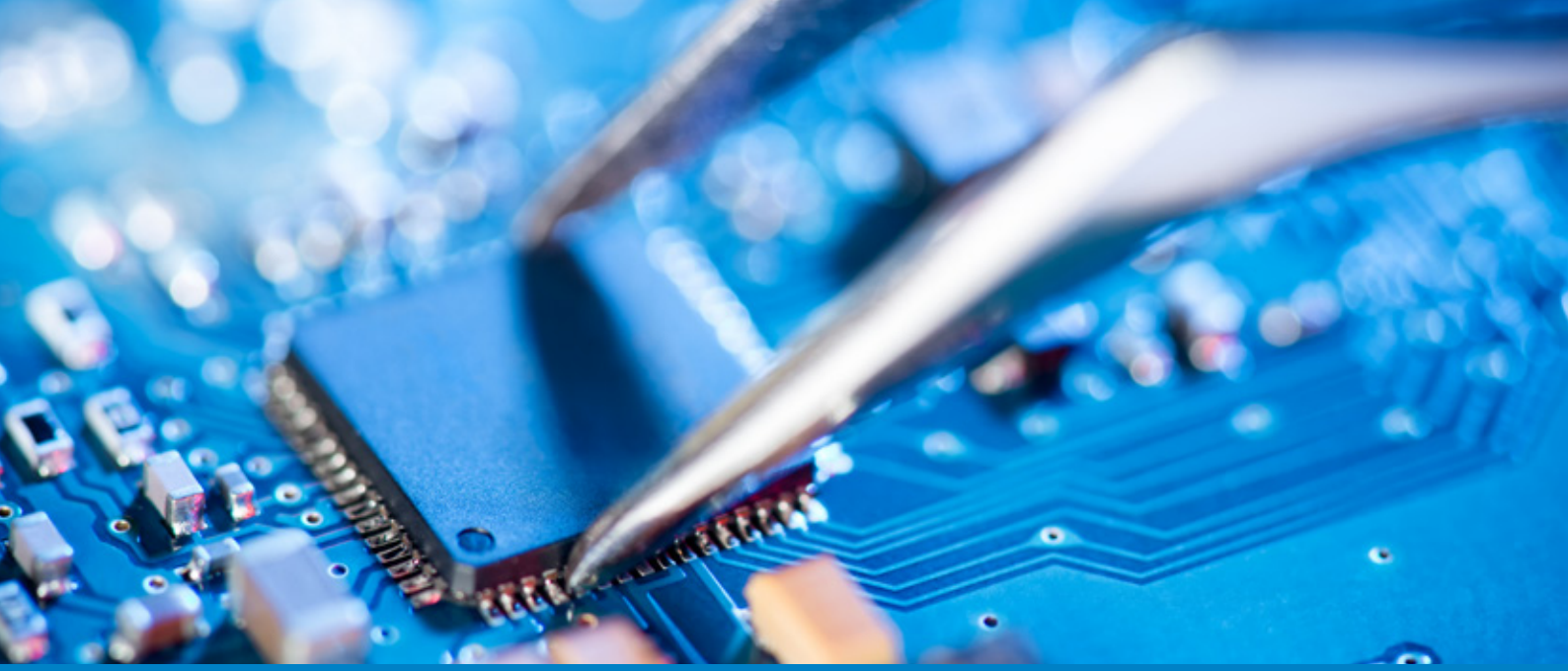

Counterfeit Component Detection

Application Note

The Challenge

Counterfeit components entering electronic supply chains is a longstanding problem with the fake semiconductor industry being estimated to be in the billions[1] in size and in 2013 counterfeit electronics worth $145 million were seized by the U.S. Government[2].

OEMs in all sectors are at risk, even the military isn't immune with a report[3] in 2012 by the Senate Armed Services Committee uncovering 1,800 cases of counterfeit parts involving over one million units.

The risk to OEMs is mostly due to pressures of supply and demand. Purchasing within the authorized supply channel guarantees visibility and trust, however component shortages can drive OEMs to use unauthorized channels. Here there is a lack of traceability providing counterfeits an opportunity to enter the supply chain.

Adding to the complexity of this issue is that counterfeit components can take many forms. The Semiconductor Industry Association (SIA) outlines how genuineness can be compromised:

- It is an unauthorized copy
- It does not conform to original component manufacturer (OCM) design, model, and/or performance standards
- It is not produced by the OCM or is produced by unauthorized contractors
- It is an off-specification, defective, or used OCM product sold as "new" or working
- The part has incorrect or false markings and/or documentation

Counterfeit components which function correctly but contain manufacturing faults represent the biggest threat to OEMs because they may pass factory tests, only to fail in service, with possibly catastrophic consequences for both user and supplier.

This application note explores complementary test and inspection techniques to identify counterfeit components to help tackle this ongoing problem.

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Counterfeit Component Detection

Application Note

The Solution

X-ray Inspection

High resolution X-ray inspection takes you beyond optical imaging, enabling users to instantly see inside incoming components and compare what they see with images from known good components. Components which look identical from the outside will often have internal differences if they are from a different manufacturer or product line (Figure 1).

Components can be inspected while still sealed within their shipping materials, making them physically and commercially easier to return if found to be counterfeit.

Anomalies in lead wires, die sizes and positions, and truncated pins can all be identified. See examples in Figures 1 and 2.

The Explorer™ one X-ray microscope from Nordson DAGE is a powerful tool for ensuring supply chain integrity as well as for detecting manufacturing defects including BGA and QFN attachment, PTH filling and cable and connector quality.

Explorer one allows you to quickly understand the quality of your product before it leaves the factory. Compact, easy to site and simple to use, Explorer one reveals hidden defects as small as 2µm.

Nordson DAGE leads the way in X-ray inspection technology enabling fast and accurate non-destructive counterfeit detection within electronic components.

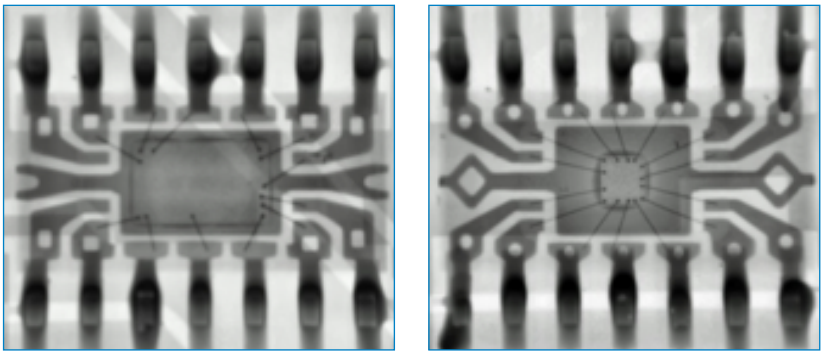

Figure 1: X-ray images of $10 transimpedance diode.
Real (left) and Counterfeit (right)

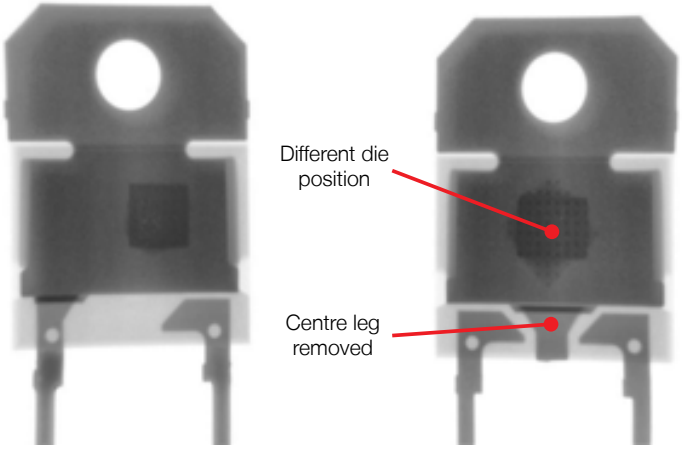

Figure 2: Ultra-fast diode – Real (left) and Counterfeit (right)

Acoustic Micro Imaging

Acoustic imaging complements X-ray techniques by providing information on different aspects of component integrity to help identify counterfeits.

Nordson SONOSCAN's advanced C-SAM® acoustic imaging technology transmits high frequency sound waves into the sample immersed in deionized water. Reflected sound waves help to accurately identify internal dimensions, cracks, voids, delaminations and interface quality issues that are characteristics of re-used components. A layer-by-layer analysis of material properties as well as material consistency and thickness help separate the real components from the imposters.

Nordson SONOSCAN developed the first-ever commercially available acoustic microscope over 30 years ago and with its years of research and experience, can apply 25 specific assessments to help determine the authenticity of a wide variety of integrated circuits and other components.

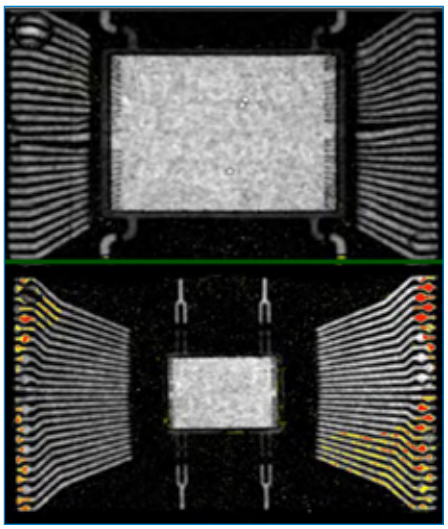

Figure 3: Close to identical in visual appearance, these two parts held internal surprises when imaged acoustically. The counterfeit component is at the bottom.

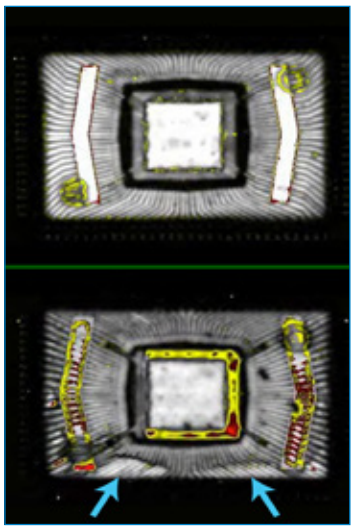

Figure 4: The component at the bottom has novel acoustically imaged anomaly seen only in counterfeits.

Electrical Testing

Electrical testing can also be used to check a component's performance against its published specification. This is done by analyzing the electrical characteristics of the component's pins when submitted to a dynamic stimulus. The pin's response is directly related to the component's nature, internal structure and manufacturing processes. This provides a strong indication that the bond wire and die configuration within the component are the same as the master sample.

Conclusion

OEMs can protect their supply chain being contaminated with counterfeit electronic components by performing a range of test and inspection techniques. Each with their advantages, X-ray inspection enables the fast verification of the die and pin configuration without unpacking the parts, essential in capturing substandard parts before they can fail in the field. This is complemented with acoustic imaging and electric testing by providing information on different aspects of component integrity. Ultimately, it is critical that OEMs implement robust test and inspection methods to avoid risking user safety, reducing their profitability and the potential loss of their reputation with the presence of counterfeit components in their products.

Nordson DAGE

Explorer™ one X-ray inspection system

Nordson SONOSCAN

D9600™ C-SAM® accoustic micro imaging system

References

[1] Industry Week, Jul 22, 2013
[2] Department of Homeland Security's 2013 Year End IPR Review
[3] 2012 Inquiry into Counterfeit Electronic Parts in the Department of Defense Supply Chain

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