

Real or Fake? The Counterfeit Chip Conundrum

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Counterfeiting is clearly a growing problem in many industries, including electronics, around the world. As the financial impact of counterfeiting has grown over the years, so has the attention that has been devoted to it by everyone from packaging, assembly, and test engineers to procurement and quality personnel. Today, many feel that counterfeiting is the number one issue that threatens the electronics supply chain.

The Electronics Market

The 2008 world market for semiconductors estimated at \$268B. The 2007 world market for semiconductors estimated at \$267B with the US sales for semiconductors estimated at \$118B. The 2007 worldwide market for electronic products estimated at \$2.0T with an estimated gross world product estimate at \$65.61T.

The total revenue of the top 10 semiconductor companies estimated at 44.6% of the total market - Intel at \$34.2B, Samsung at \$17.9B, Toshiba at \$10.5B, TI at \$9.8B & ST Microelectronics at \$9.7B.

Top electronic franchised distributors are Arrow with estimated revenue of \$16.7B, Avnet with \$16.5B, WPG with \$4.7B, Future with \$4.4B & Bell with \$4.0B. Product is also sold in the market to CMs (contract Mfg) & OEMs (Original Equipment Mfg) by independent distributors & brokers. The top 5 independent distributors alphabetically listed are Advanced MP, America II, Classic Components, Converge & Smith. Total independent distributors combined revenue for 2008 estimated at \$1.4B. In addition, over \$1.0B is sold through broker network of about 1,100 brokers.

Counterfeit Definition

- An unauthorized copy
- Doesn't conform to original OCM design, model and/or performance standards
- Not produced by the OCM or is produced by an unauthorized subcontractor
- An off-specification, defective, or used OCM product sold as "new" or working
- Has incorrect or false marking and/or documentation

Scope of Global Counterfeiting

- Current value of counterfeit electronic components is estimated at approximately \$10b annually
- One recent seizure alone was \$1.3b
- Counterfeiting costs the US economy between \$200b - \$250b annually
- Overall global counterfeit goods are estimated at \$3.9T



Figure 1

Until a few years ago, we were used to seeing counterfeit activity in money, unauthorized copies of movies and Rolex knock-offs. Today counterfeiting of chips has become a major industry ill.



**ICs being dried in the sun
outside a shop.
Many with slightly bent pins.**



Workers sorting out ICs at two different shops.

Figure 2

Sophisticated Counterfeiting

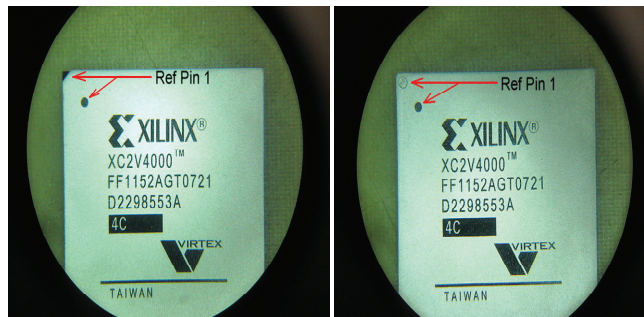


Figure 2 & 3

Marking on part A and part B are identical.

Observed differences on lid corners. Part A has chamfer, and part B has dimple

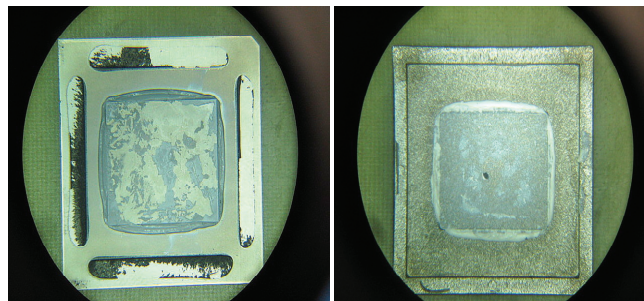


Figure 3 & 4

Observed internal differences on lids. Part A flat lid, and Part B cavity lid

Combating Counterfeiting

The threat of counterfeit has become so great that many governments around the world are taking a much more active role in combating it; however, finding counterfeit electronic components at the macro level is not an easy or quick process. Furthermore, most companies that receive counterfeit components many times hide or simply do not publicize this fact fearing it will alarm their customers.

So they end up working in more of a reactionary mode to deal with counterfeit problems as they come up. In addition, many companies lack the resources and internal experience to effectively define and detect fakes. Possibly the biggest issue in attacking counterfeiting is the large amount of misinformation in the marketplace and the lack of credible information within many areas of the supply chain.

Customers throughout the chain are looking for that “magic piece of paper” that says the parts they are buying are okay. The problem is, the procedures and/or tests done in connection with this “magic piece of paper” may not really provide them the comfort they or their customer really wants.

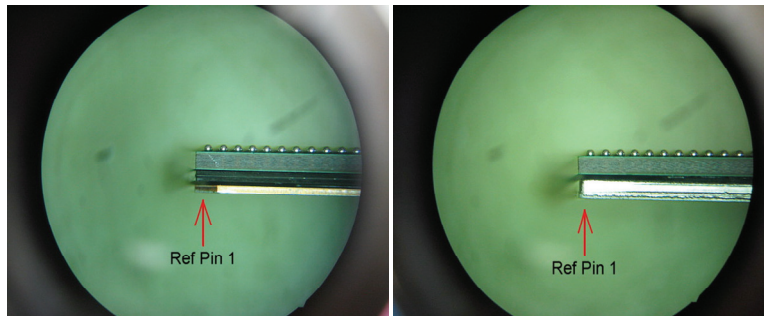


Figure 5 & 6

Observed side view differences. Part A thin lid and part B thick lid

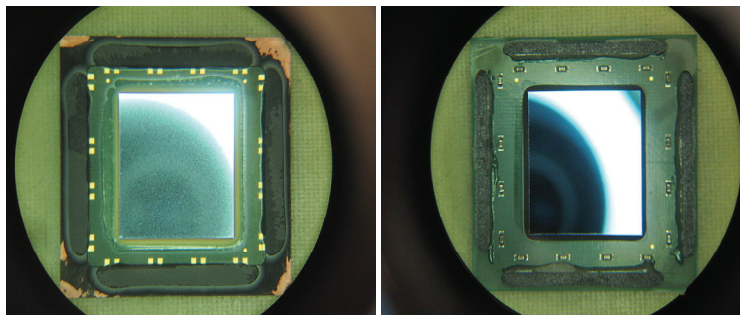


Figure 7 & 8

Observed chip capacitors are missing (bare pad site) on part A and mounted on part B

Counterfeit Detection Methods

Detection Method	Advantage	Disadvantage
Visual Inspection	<ul style="list-style-type: none"> ✓ Non-destructive ✓ Easy to detect optically ✓ Can Detect less complex counterfeits quickly 	<ul style="list-style-type: none"> ✗ Limited to parts altered externally only ✗ Functionality of dead units not verified ✗ Can not detect complex counterfeits
X-Ray	<ul style="list-style-type: none"> ✓ Non-destructive ✓ Can Verify die location size & orientation ✓ Can Verify interconnection to the package 	<ul style="list-style-type: none"> ✗ Limited to parts without metallization above/below die ✗ Doesn't allow Internal verification of the logo or marking on die ✗ Needs a good device to compare the X-Ray image to
Decap	<ul style="list-style-type: none"> ✓ Destructive ✓ Photo of device connection to package ✓ Can Compare die photo to known good die photo 	<ul style="list-style-type: none"> ✗ There might be no etching of logo or characters on die ✗ Can not detect functionality dead-units ✗ May not be able to access a known good part to compare to ✗ Inability to obtain archive copy of die photo ✗ Chemical etch process
Basic Electrical Counterfeit Test	<ul style="list-style-type: none"> ✓ Non-destructive/destructive ✓ Ability to bench test ✓ Normally 2 - 5 parts ✓ Quick test ✓ Typically DC test for continuity & ICC ✓ Can determine if part is authentic 	<ul style="list-style-type: none"> ✗ Functionality not verified ✗ If destructive – scrap of expensive or scarce parts ✗ More expensive than visual & decap
Limited Functionality Electrical Test	<ul style="list-style-type: none"> ✓ Non-destructive/destructive ✓ Covers most devices ✓ Provide comfort on functionality ✓ Verify a larger sample size 	<ul style="list-style-type: none"> ✗ Grade & speed of device not verified ✗ Full device functionality not verified ✗ Timing of results if load board is needed ✗ If destructive – scrap of expensive or scarce parts ✗ More expensive than previous tests

Combating Counterfeiting

The threat of counterfeit has become so great that many governments around the world are taking a much more active role in combating it; however, finding counterfeit electronic components at the macro level is not an easy or quick process. Furthermore, most companies that receive counterfeit components many times hide or simply do not publicize this fact fearing it will alarm their customers. So they end up working in more of a reactionary mode to deal with counterfeit problems as they come up. In addition, many companies lack the resources and internal experience to effectively define and detect fakes.

Possibly the biggest issue in attacking counterfeiting is the large amount of misinformation in the marketplace and the lack of credible information within many areas of the supply chain. Some customers throughout the chain are looking for that “magic piece of paper” that says the parts they are buying are okay.

The problem is, the procedures and/or tests done in connection with this “magic piece of paper” may not really provide them the comfort they or their customer really wants.

Detection

Decapsulation, x-ray, investigative visual inspection, and functional testing are some of the methods used to detect counterfeits. What do each of them really tell you in regard to counterfeit detection and how much comfort should each give you?

Some suppliers state that a sample number of their parts were x-rayed. As a result they guarantee that their parts were clear of any counterfeits when shipped.

The reality is that if a part is x-rayed, one can only determine that there is a die in the encapsulation and that it is bonded-out. There are many more things that are not answered if x-ray is the only testing done.

For example, is this the correct die? Is there a known good part with which to compare it? Will it function as it is supposed to based on datasheet specs? Is it even electrically sound?

There are many questions, yet there is no single, systematic approach or universal standard that everyone has agreed on as it relates to counterfeit testing. Customers are forced to rely on the credibility of various internal and external test facilities in providing data and testing that they can count on. Some of these facilities are better than others.

Furthermore, some of the external test facilities do not provide certain information as to the actual tests performed, equipment used, etc., stating that they cannot provide this information because it is proprietary. This creates even more uncertainty for the customers

Time Consuming and Expensive

Detecting counterfeit components is a tough process that can be time consuming and expensive. However, if someone puts in the time and effort, there are many things that can be done to help minimize counterfeit product.

First, educate yourself. There are various resources like the IDEA-STD-1010-A for inspection of electronic components that can be used as a reference guide. A good test house can also be invaluable to help set up a strategy for counterfeit detection for your company.

In an effort to find a good test house, don't be afraid to ask a lot of questions and take the time to visit. A credible test house should allow you to tour their facility and be willing to share testing and equipment information with you.

If you get a quote that seems too good to be true for one of those "magic pieces of paper," it probably is. In the same vein, in selecting sourcing partners, do your homework by visiting them. There are some extremely good independent distributors that have taken very credible steps to eliminate counterfeit product. Have them explain and show you what strategy they have implemented.

Look in the Right Places

It is ironic that one of the main benefits of sending product manufacturing overseas was the reduction in product cost. This is also the same set of circumstances that results in a significant offset to that price reduction in the form of additional counterfeit-related costs to the marketplace.

People are looking for answers to this difficult issue. There is help out there if you look in the right places.