'Delidding' ICs to verify chip authenticity

Rampant counterfeiting in regions such as Asia has made strict research into the documentation and authenticity of chips an essential prerequisite for accepting ICs for integration into manufactured products. E-Certa uses a patent-pending 'delidding' process to examine a chip's internal structure and uses a metallurgical microscope to perform a complete sweep of the sample IC from micromillimeter to micromillimeter, capturing chip images and performing research to ensure that the logo on the chip is authentic.

By Joel Deutsch

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The challenge of counterfeiting

Counterfeiting is rampant within electronics. Delidding is an increasingly popular service to ensure that the parts used are the parts specified. The service includes lifting the lid of a component package and using a metallurgical microscope with software for camera hook-up to capture images of the die inside the package to check for authentic identifications.

There has been an incredible influx of counterfeit material from Asia - to the point where counterfeit versions of virtually every electronic component are readily available.

Counterfeiting takes many forms. In some cases, counterfeiters abrasively remove existing IC markings, blacktop the ICs, and lay down new ink. Sometimes they do high-quality remarking that is difficult to distinguish from markings on authentic ICs. The only telltale difference in some cases may be that the top of the IC is darker than its sides; color should be consistent across the chip.

Counterfeiters sometimes remove identifying date codes on perfectly good ICs. The product may be acceptable otherwise, but counterfeiters may re-mark ICs to ensure they are within a two-year date code to enable delivery.

In many cases, however, the problem is actually far worse. E-Certa has delidded a variety of ICs only to find that some have the correct package and identification markings but contain an incorrect die - or in some cases - no die at all. Counterfeiters also may create totally counterfeit dies with chips that may in fact work, but that are not from the fab represented on the label.

Sometimes counterfeit devices are marked upside-down. When the OEM receives them, the OEM may not realize this and may attempt to insert them into a printed circuit board. Because of the faulty marking, however, pins will never properly align.

There are also situations where everything looks perfect - factory boxed, factory sealed, correct cart number, but the IC itself is wrong.

Certificate of conformance not enough

Even material content marking is subject to counterfeiting, since counterfeiters may mark devices 'no lead' when in fact they are leaded, and vice-versa.

Taken together, all this will cause a tightening of regulations. Today, regulators suggest XRF (x-ray fluorescence spectroscopy) for confirming IC authenticity... but we expect tomorrow's regulations to make XRF mandatory.

A number of companies are already instituting counterfeit prevention programs. When Honeywell, for example, buys from vendors who do not have complete traceability on IC products, they now require delidding before

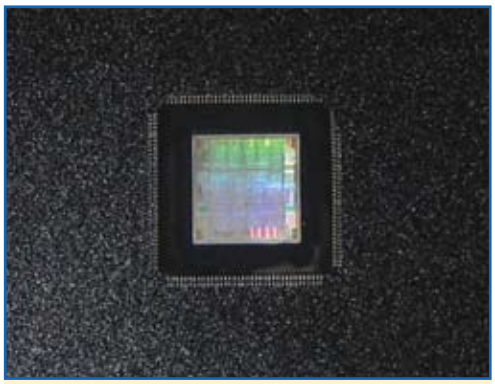

Figure 1. A 'de-lidded' IC.

Figure 2. A metallurgical microscope set up to capture images of the die inside the package captures this close-up of a die's identifying marks.

Figure 3. Another image from a die shows a close-up of the die's logo. The logo is researched to determine if it is authentic.

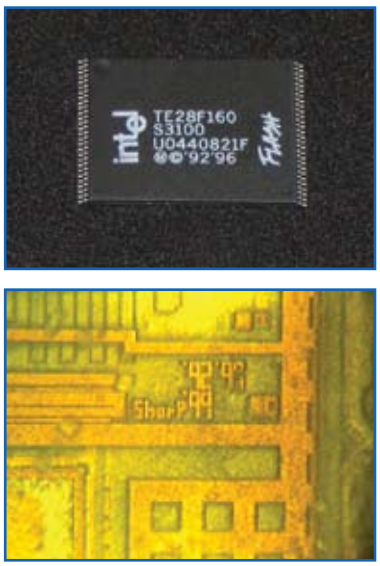

Figure 4. This Intel die had Sharp logo and part number inside. The chip turned out to be properly licensed between Sharp and Intel.

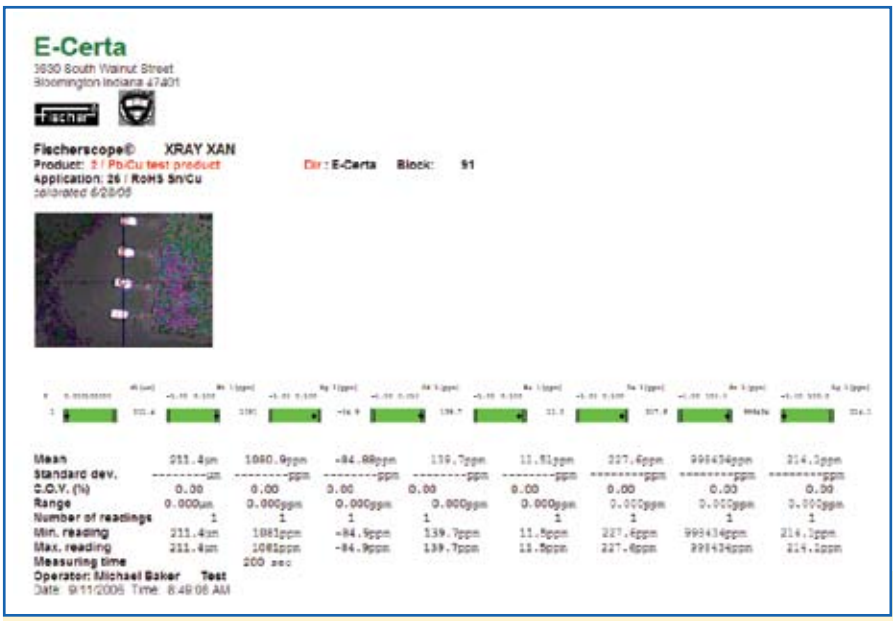

Figure 5. E-Certa sample report (RoHS Passing).

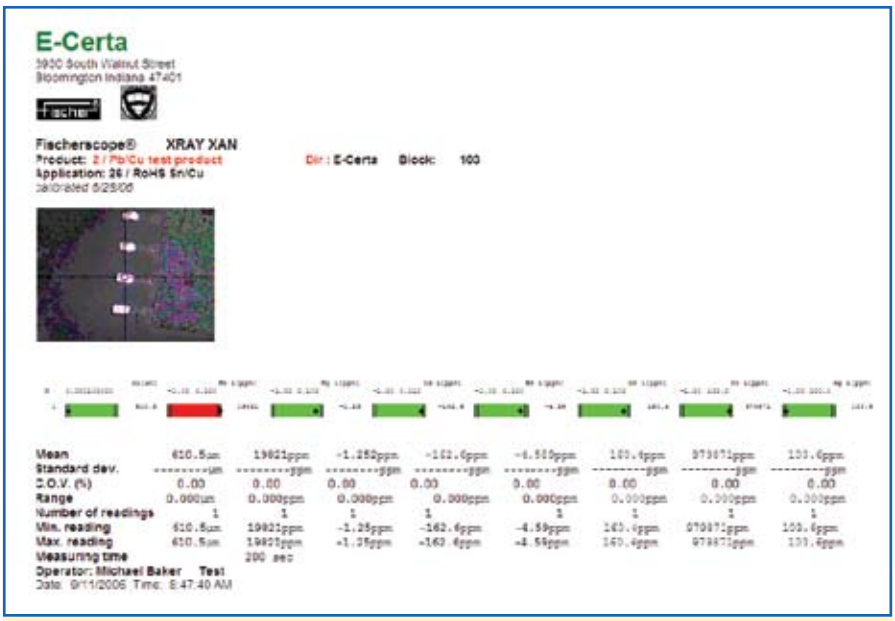

Figure 6. E-Certa sample report (RoHs failing).

they will allow the purchase to enter their facility. Our own XRF lab has been testing the consistency of material used in dies to assess that it is what it purports to be. It was a natural evolution for us to become involved in delidding to detect counterfeit ICs.

The emergence of delidding

Delidding was originally undertaken in connection with DPA, or destructive physical analysis. The military has analyzed chips that weren't performing properly, and when they found no solder issues, they elected to go inside the die to have a detailed failure analysis performed.

E-Certa does not do failure analyses - we simply do delidding and visual inspection to identify the die by looking for the logo inside, and by verifying the part number.

OEMs should be aware, however, that logos found inside dies can themselves sometimes be misleading. For example, we opened an Intel die and found a Sharp logo inside with a Sharp part number. Upon research we found that the chip was not counterfeit - it was properly licensed between Sharp and Intel.

The delidding process

After removing the lid, E-Certa utilizes a metallurgical microscope to perform a complete sweep of the sample IC, micromillimeter by micromillimeter. The microscope captures chip images and research is performed to ensure that the logo on the chip is authentic. Often the part number is inside the die or there is an identifying part number and logo that facilitate authentication.

There are cases in which vendors buy ICs from several sources, which they in turn use to supply a single OEM. To ensure that each lot is genuine, a sample from every different lot code from each source should be delidded.

In many cases, ICs are undergoing reliability testing or already have been incorporated into production products when intermittent failures or other anomalies begin to indicate that there may be problems. One OEM notified us of problems with a Philips-branded part and asked us to delid samples. At the same time, we received a conversion order for the identical part number from another company. The OEM wanted us to delid ICs that were either white-inked or laser-etched. The laser-etched chips were suffering intermittent failures.

We delidded both and found identical dies and markings - everything matched perfectly. We then performed XRF testing on the contents which showed the device to be leaded, though it came close to passing RoHS. We determined that material changes by the manufacturer -

which had been undertaken in pursuit of RoHS compliance - had led to solderability issues, and those in turn were causing those intermittent breakdowns in performance. The bottom line: some manufacturers have switched to no-lead production and sent it into the market *without announcing the change or notifying customers, and that has in some cases created usability issues.*

In most cases, E-Certa provides a 48-hour delidding turnaround on a one-sample-per-lot basis.

Delidding customer experiences

Chris Joseph of Lintech observes that the impetus for delidding "is being pushed down from upper levels. Boeing, Lockheed, and Raytheon, for example, are pushing that responsibility down to the distribution level. They are requiring that independent distributors must delid all products on which the distributor doesn't have full traceability to confirm that the specified dies are in place and that they work 100%."

Lintech deals mostly with chips used by the military, and delidding to verify authenticity is essential. "Out of certain areas in China, they're counterfeiting everything," Joseph says. "If the price seems too good to be true, it usually is. We know what areas to stay away from."

Ed Giller of Vintage Components uses delidding to get to the bottom of situations where he's even remotely suspicious. Looking at one set of components, Giller recounts, "It looked to me like they had been remarked."

Although appearance is often a tip-off, there are other indicators as well. "You have to play detective," he says. "In your incoming inspection, you have to take a really hard look at the parts you're getting unless you're getting them directly from the manufacturer. Good incoming inspections check for the right date codes and part numbers. Sometimes you get the wrong package or the wrong parts. It must meet customer specifications." Giller looks at chip aesthetics – if its appearance is anything other than what is expected in terms of color and marking, he regards it as particularly suspicious.

Giller describes the delidding process as "well worth the money," but says in some cases, chipmakers are less than forthcoming with die maps that can be used to verify chip authenticity – particularly if the chips weren't purchased from authorized distributors.

All customers described the delidding process as expeditious and usually reassuring. Being very careful about sources of overseas chips is regarded as an indispensable first step.

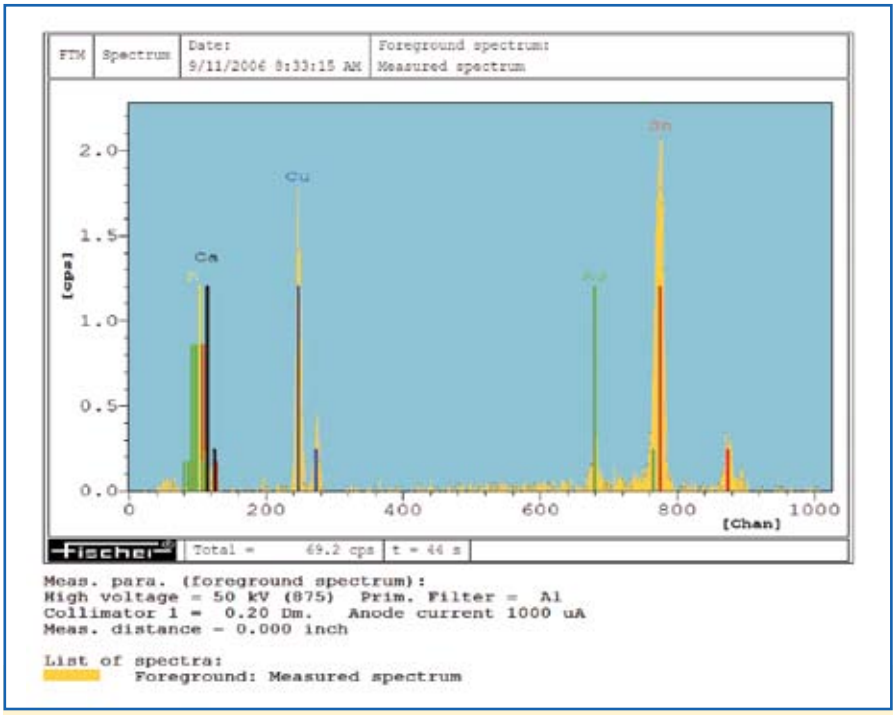

Figure 7. XRF spectral analysis of RoHS compliant material.

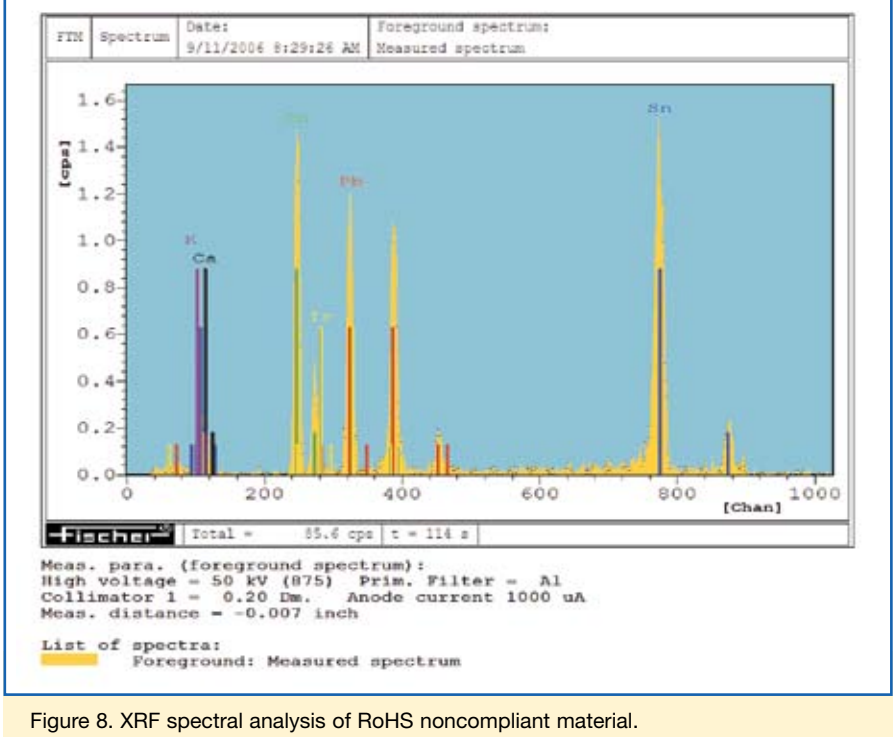

Figure 8. XRF spectral analysis of RoHS noncompliant material.

Joel Deutsch began his electronics career in 1977. In 2000 he developed Earth4Humanities, a non -profit organization that donates computers to low income, single parents. In 2004 Joel opened E-Certa, after 2 years of testing, researching, developing and establishing patent pending rights and license agreements for his process through New Way Technologies.