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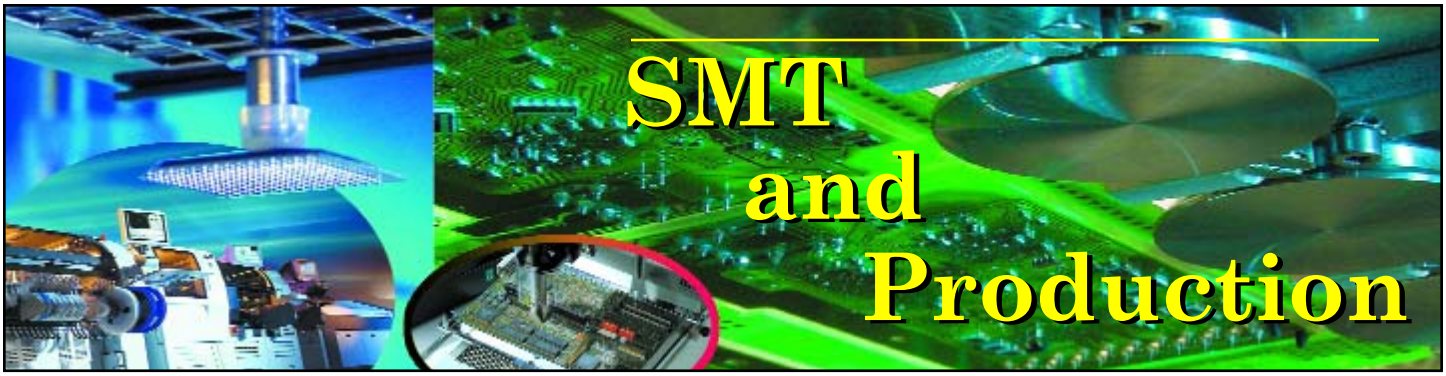
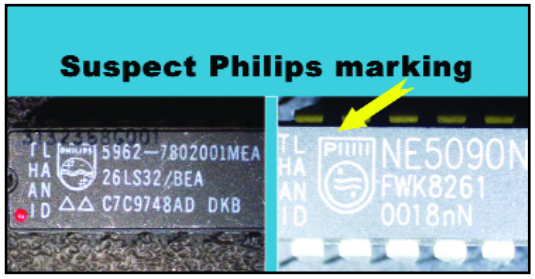


Stopping Counterfeit Parts Before They Do Damage

**By Joseph G. Federico, Vice President, Director of Operations,
NJ Micro Electronics Labs, Inc., Clifton, NJ**

Imposters seem to be creeping into all facets of our life: fake IDs, knock off designer handbags, and now, frighteningly, even into our electronic components supply. But thanks to a groundbreaking program created at NJ Micro Electronic Testing, Inc. (NJMET), the imitation electronic devices that began infiltrating the industry close to a decade ago can now be detected and stopped. It's important that this happens before they are used in the manufacture of products that could put many projects and hundreds of thousands of lives in danger.



Suspect Philips marking covers old Philips marking for a different part.

A special testing program has been devised to detect and stop the flow of counterfeit devices by the highly qualified technicians in the labs at NJ Micro Electronics Labs, Inc. (NJMET). Called "Mission Imposter®", it is the world's first counterfeit component detection program. This testing process detects counterfeit electronics before they find their way into a customer's products.

The process begins with an analysis of the shipping and packaging. The parts then undergo several levels of inspection including: marking and dimensional checks, internal visual analysis, several levels of material analysis and electrical testing to determine as well as insure authenticity.

The testing consists of 11 steps: Incoming Inspection, Electrostatic Discharge Surface Inspection, Physical Dimension, Marking Permanency (Resistance to Solvents), Radiographic Inspection, Internal Visual Verification, Die /ID Composition Die , Group A Electrical Testing, Material Analysis, CSAM, Accelerated Life Testing, and Engineering Consultation.

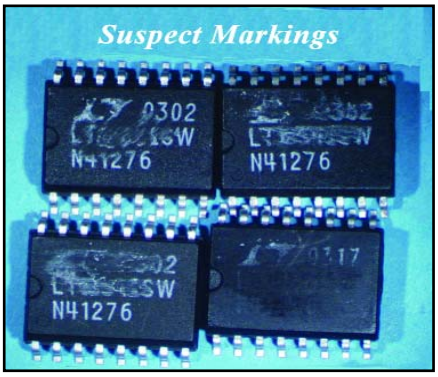
Incoming Inspection. The inspection process begins by checking the boxes for any shipping damage or evidence of a counterfeit or suspect bar code label and then continues on to the component level with the opening of the packages.

An in-depth, nearly 100-point inspection process follows, using a detailed checklist of suspect error types. Optical microscopy (digital imaging) is performed to verify the component part number, marking, lead straightness, color, or any anomaly related to the integrity of the devices, such as cracks, dents, scratches, mechanical anomalies, spelling errors, suspect date codes, suspect manufacturers logos, breaks, or corrosion.

ESD — Electrostatic Discharge Surface Inspection. Because electrostatic discharge is one of the most serious problems facing the electronics industry today, trained operators thoroughly examine the components and packaging to detect evidence of plastic, styrofoam, rubber bands, cardboard, scotch tape or any substance capable of inducing static electricity around the product. These

particular items can cause the "shock" from static electricity. Although ESD may seem harmless, it can damage electronic components and their assemblies when they are not packaged or handled properly.

Physical Dimension. The devices are measured for their height, length, width and depth thicknesses as well as arc angle, curvature measure and pin count to insure all data meets the manufacturer's specifications — looking carefully for any evidence that the component has been altered in any way.



Several suspect devices with markings that were smeared by standard solvents.

Marking Permanency (resistance to solvents). The purpose of this test is to verify that the markings will not become illegible on the component parts when subjected to solvents — something that happens in many cases in the growing epidemic of counterfeit components. Various military standard procedures are used which incorporate processes of working with several chemicals mixed appropriately, and making certain that detail is in accordance with the specifications. These chemicals consist of aliphatic alcohol, mineral spirits, ethyl-benzene, organic solvents, deionized water, propylene glycol monomethyl ether, or monoethanloamine. Once these solvents have been properly mixed, the components are submerged in a three-phase process and analyzed in accordance with MIL-HBK-130. This is done to uncover evidence of damage to the device and any specified markings which are missing in whole or in part, faded, smeared, blurred, or shifted (dislodged). The specs indicate that markings should be readily identifiable from a distance of at least 15.0cm (6-in.) with normal room lighting and without the aid of magnification or with a viewer having a magnification no more than 3X. If the components do not meet this ID test, they have failed. In some cases, a strategic acetone wash will be used to reveal sanding marks and facets of previous markings.

Radiographic Inspection. Real-time x-ray and shadowgraph x-rays are performed to observe evidence of counterfeiting by analyzing the die size, wire bonding, and to uncover any possible de-laminations.

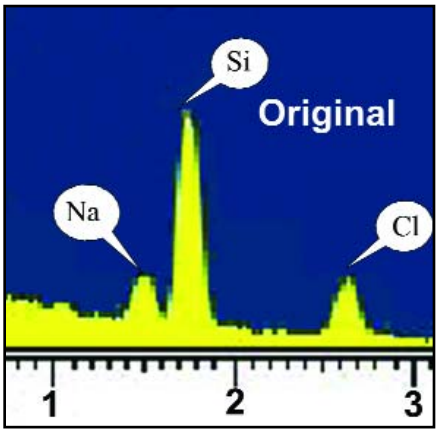
Internal Visual Verification — Die/ID Composition Die Verification. Component samples are de-lidded and an internal inspection is made. The die is checked for defects and the manufacturer's logo on the die must match that on the lid of the component. The die topography is also analyzed to see if it meets the outline of the manufacturer's requirements. The component is placed under a high powered microscope and verified against the manufacturer's specifications. Photographs of this process are taken each step of the way.

Group A Electrical Testing. Group A testing is industry terminology used regarding testing the component devices' full functional and parametric requirements at the recommended manufacturers temperature or specific industry extreme operating temperatures.

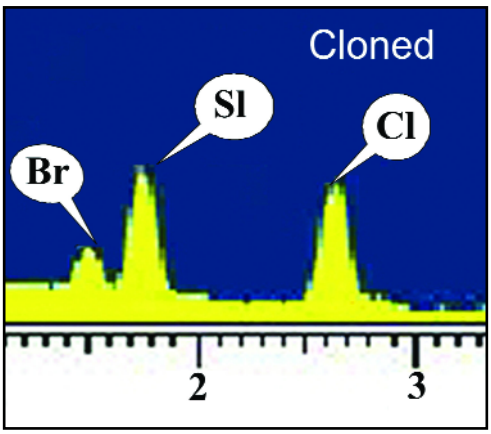
For commercial applications, the temperature range is 0 to +70°C for DC, AC functional and parametric testing. For industrial applications, the temperature range is -40 to +85°C for DC, AC functional and parametric testing. For automotive applications, the temperature range is -45 to +110°C for DC, AC functional and parametric testing.

For military and aerospace applications, the temperature range is -55 to +125°C for MIL Subgroups 1, 2, 3, 4, 5, 6, 7, 8A, 8B, 9, 10, and 11. For space applications, the temperature range is -65 to +150°C for MIL Subgroups 1, 2, 3, 4, 5, 6, 7, 8A, 8B, 9, 10, and 11.

The test objectives are to exercise the DC and AC Functional and Parametric requirements as indicated by the various specifications. In cases of military, aerospace and space design, the respective subgroups contained in those documents would suffice for the objective tests.



Spectral analysis of coating of good part.



Spectral analysis of coating of counterfeit part.

Material Analysis. A four-point inspection of the device die, leads, bond wire and packaging are performed to verify material authenticity. There are four specific materials tests performed separately or together based on suspect matter in or order to determine material authenticity.

- SEM — Scan Electron Microscopy. This analysis uses a focused beam of high-energy electrons to generate a variety of signals at the surface of the specimens. The signals that derive from electron-sample interactions reveal information about the sample including external morphology, chemical composition, crystalline structure and orientation of materials which make up the sample. This test is performed in order to see if these structures are indeed authentic and meet the manufacturer's requirements.
- EDXA. Energy dispersive X-Ray Spectroscopy

is an analytical technique used for the elemental analysis or chemical characterization and verification to see if the elements are verified in accordance with the manufacturer's requirements.

- FTIR. Fourier Transform Infrared Spectroscopy is used mostly for identifying chemicals that are either organic or inorganic and is useful in identifying polymer coatings and contaminants which are useful in identifying counterfeit electronic products.
- XRF. X-Ray Fluorescence Energy Dispersive test is performed to characterize individual particles to verify that the product meets manufacturing criteria both quantitatively and qualitatively.

CSAM. Acoustic Microscopy is a screening technique used to uncover anomalies in the device package and construction. It has been most reliable in uncovering distinct differences in device surface coatings which have identified many counterfeit devices.

Accelerated Life Testing. In recent years, much useful methodology has been developed to predict the life of electronic microcircuits using environmental accelerated steady-state life testing. Such acceleration testing experiments can be vital in predicting the operational future and functional performance of either hermetically sealed or plastic encapsulated microcircuits.

Testing such as Component Temperature Cycling or Burn-In have been very useful in exposing counterfeit devices. In September of 2008, the author was the first American engineer to present Mission Imposter to the Eastern European OEMs and CEMs and their engineering consultants at the first Russian Counterfeit Electronics Awareness Conference in St. Petersburg, Russia.

During the question and answer forum that followed, it was learned that many engineers throughout the region had difficulty uncovering counterfeit/ cloned electronic product due to the fact that they worked functionally and parametrically in performance tests.

In cases where manufacturer's data sheets or authentic devices were available to determine authenticity, the process of accelerated life testing became a strong methodology in weeding out the probable suspect devices.

Engineering Consultation. The key solution — NJMET takes great pride in the company's depth of quality electronic component testing and solution expertise over a period of 30 years.

While all the methodologies listed are not needed to resolve each matter, the company will research each individual project and provide and meet the best consultation objectives for the test. NJMET will provide additional experienced recommendations including legal and industrial advice as well as expert witness testimony.

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