# Facing the Counterfeit IC Issue

*“Fake” chips in the marketplace is a huge issue for manufacturing companies and distributors alike. Here is a solution to that problem*

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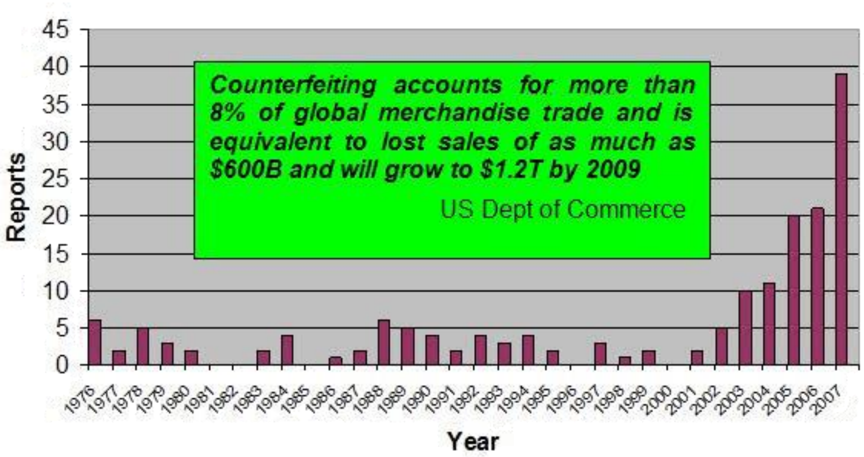
## *The Problem*

ICs are not like banknotes – hard to copy, and making fake “lookalike” parts which resemble real ones takes very little skill. It simply requires finding cheap parts in the same package and merely painting new marks on them. This problem has arisen due to the high value of electronics parts, and the whole manufacturing chain from assembly house to end-user is vulnerable. The number of companies that have been duped by batches of fake devices is incalculable.

Counterfeiting semiconductors has been rapidly increasing, impacting a wide variety of electronics systems used by a wide gamut of involved parties - consumers, businesses, and military customers. The detection of counterfeit components has become an increasingly important priority, especially for electronics manufacturers and component suppliers worldwide.



*Counterfeiting accounts for more than 8% of global merchandise trade and is equivalent to lost sales of as much as $600B and will grow to $1.2T by 2009*

US Dept of Commerce

## *What are counterfeit components?*

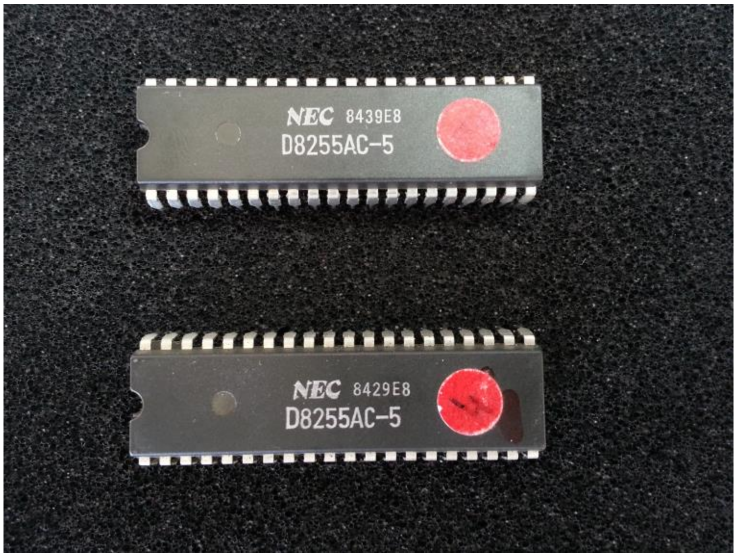
The most prevalent counterfeiting technique is re-badged product. It is a simple matter to remove the existing mark from a chip package and put on a new logo and part number, or a different brand, a different speed – and sell the semiconductor to an unsuspecting buyer who has no way of making sure that the product is “real”. Sometimes the chip is only an empty package with no die inside. It is true that the finished system would fail before it left the factory – but this still requires expensive investigation and rework, with no part available to replace the bad one, causing the dreaded exclamation “Line Down!” But the failure of borderline ICs may not occur until the system is in the field, and field repairs can cost ten times as much to fix as those caught before they leave the factory.

Counterfeiting can also be from chips which are gleaned from discarded scrap boards. After remarking with a different manufacturer’s logo, they are inserted into the supply chain and sold to innocent buyers - who naturally who assume that the products are genuine.

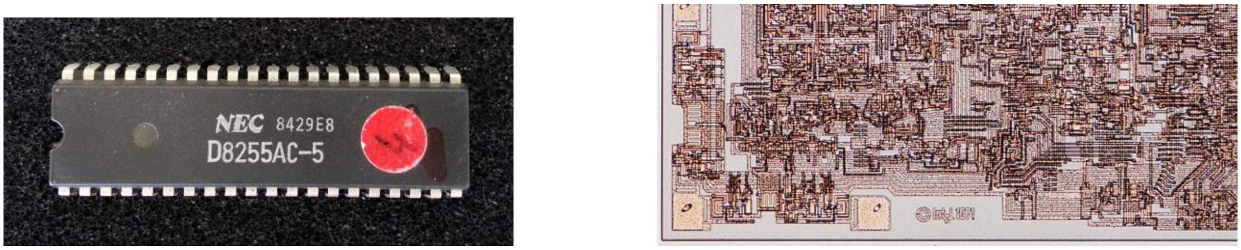
Usually, it is impossible to identify counterfeit components until they are fitted on a PCB when the first tests are made on the final product. Failure requires the costly identification of the components at fault and then lifting them from all boards in the production line. Complete batches of finished products may need to be recalled to the factory – directly hurting a company’s bottom line.

Technical measures to solve this problem have previously included visual inspection of devices for marking errors – which needs a trained eye for all possible variations in marking.  Electronically testing or x-raying every incoming batch is another technique. Another destructive method is to use a complex decapsulation system in order to visually inspect IC die sample, immediately losing revenue due to the component’s destruction.  Not only is this expensive and time consuming, it requires complex training, skilled operators, and expensive equipment.

***Example 1:*** *Chip package markings can be made to look almost identical to the uncritical observer. Can you tell which is the genuine IC?*



***Example 2:*** *The outside package marking in this case does not match the die inside when the top cover is destructively removed.*



### *Screening*

Some distributors have advertised their screening services for verifying components, with a turnaround time of “as little as two days”.  That is unacceptable in many cases. These companies offer techniques such as: x-ray, x-ray fluorescence analysis (XRF), decapsulation, heated solvent testing, visual inspection, and solderability testing, resulting detailed reports – when all that was required was “is it a good part?” In reality, this approach is only viable for military or large volume production runs.

What the electronics manufacturing industry really needs is a tool that can verify the identity of received ICs quickly and economically, using a statistically significant procedure; a tool that is suitable for all devices and packages, simple to use by any operator, and gives fast “good/suspect/fail” results.

In fact, there is such a commercially-available device - the **ABI SENTRY Counterfeit IC Detector**. **SENTRY** is a PC-driven product that uses a complex **PinPrint™** Test Algorithm to check the validity of parts in seconds. The product is very simple to use and enables any receiving department to operate the equipment with minimal training.  The analysis takes place in the background and the operator only sees a simple “Good Device”, “Blank Device” or “Fail Device” message, with the option to produce a detailed report to send to the supplier.

**SENTRY** contains a set of ZIF sockets accepting adapters for DIP, SOIC, BGA, SSOP, as well as discrete components.  The system uses a comparative technique to rapidly analyze and learn new components, and then test the unknown parts. A known good component is locked into the ZIF socket while a test pattern is applied across all its pins. The component’s response to this test pattern, or **PinPrint™,** is automatically measured and stored as a benchmark. **SENTRY** uses a combination of electronic parameter settings (voltage, frequency, source resistance and waveform) to generate the “signature” for each pin of the IC being checked.  It then compares the unique electrical characteristics of known components and with suspect components.  Testing between every possible pin combination is included, maximizing the chances of capturing internal fault conditions. **SENTRY** can quickly detect missing or incorrect dies, lack of bond wires, inaccurate pin outs and pin impedance variations. Simple pass or fail results are returned after testing, offering a high level of confidence in the authenticity of components.

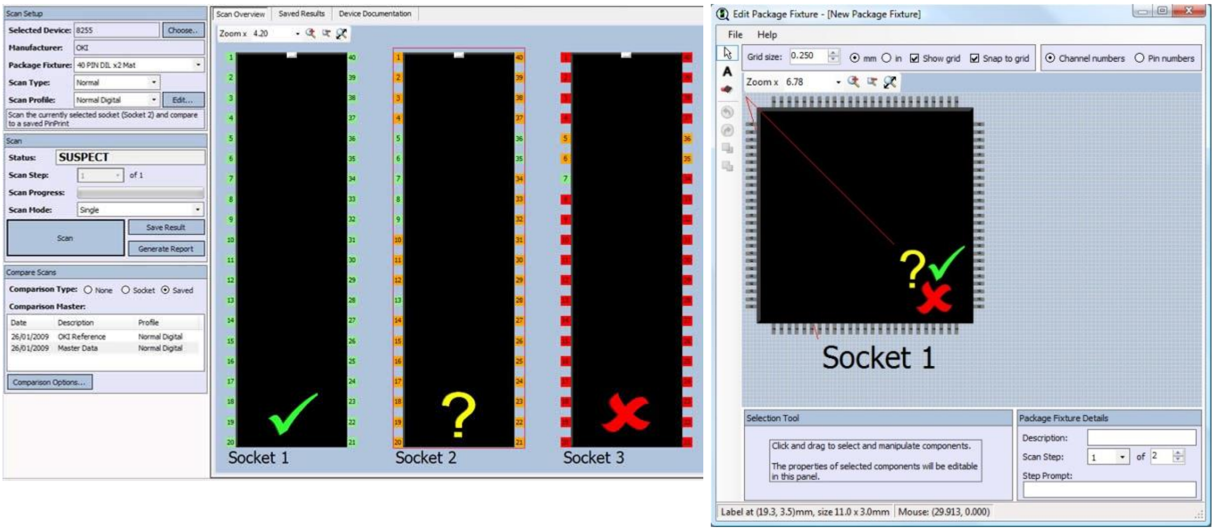
As parts become increasingly complex, 100% testing becomes burdensome, but testing one or two pieces for, say, 200 pieces is manageable. Experience has shown that variations arising from a suspect shipment will reveal themselves well before such a test is complete.  Nevertheless, if 100% non-destructive testing is required, using a **SENTRY** Counterfeit IC Detector is the ideal solution!

**SENTRY** is a unique solution for the quick and easy detection of counterfeit ICs and components. It is able to identify parts that have a different internal structure, or no structure at all, and even components originating from a different manufacturer. SENTRY is an easy to use instrument, capable of checking all types of components, ranging from simple two pin devices to more complex packages such as QFP and BGA.

Controlled via USB using the provided PC software**,** **SENTRY**’s device library can be built up by adding specific known good devices. Each device can have documents associated with it, such as photos of device markings, data sheets, and other documents to further help in confirming the integrity of a device. **SENTRY** contains all the hardware required to analyze the electrical characteristics of ICs with up to 256 pins. 256 pins+ devices can also be tested by rotating the device (BGA, QFP) to allow all pins to be learned and compared. **SENTRY** is supplied with four 48 pin dual in line (DIL) zero insertion force (ZIF) sockets; these can be used directly for older DIP components but can also be used to accommodate a variety of additional socket adapters available for different package types. The socket adapter can contain multiple IC sockets if required, to allow testing several ICs at the same time or comparing one IC with another. An expansion connector allows custom socket adapters with up to 256 pins to be attached.

Designed in Europe by ABI Electronics Ltd., a leading manufacturer of PCB testing equipment, **SENTRY** has been conceived with component distributors and manufacturer Receiving Departments in mind for sample testing. Other application areas include electronics components suppliers using **SENTRY** to improve their quality assurance programs. Detailed reports can be saved to provide quality control traceability. **SENTRY** guards production facilities from the infiltration of counterfeit devices, identifying bad parts before they are mounted on PCBs - saving time, money and frustration. **SENTRY** does not require any knowledge of electronics to use efficiently. After testing, the operator can just be presented with a simple “Good Device”, “Blank Device” or “Fail Device” message, but for in-depth analysis, **PinPrints™** can be reviewed and full reports can be generated. In order to ensure consistency throughout the whole supply chain, **SENTRY** is designed to support data sharing - the **PinPrints™** of a given component can be shared between users, from the OEM through to the distributor and end user.

**ABI Sentry** is housed in a sturdy metal box (10.6” x 10” x 3.6”) and weighs 8lbs, and can receive separate interchangeable adapters for accepting various IC packages under test. With its large range of optional adapters, **SENTRY** can accommodate most types of IC packages, including DIP, SOIC, PLCC, QFP and even BGA. For simplicity of operation, **SENTRY** has no display or keypad, but is entirely controlled by a PC via USB using ABI’s custom designed free software.


Scan Setup
Selected Device: 8255
Manufacturer: OKI
Package Fixture: 40 PIN DIL x2 Mat
Scan Type: Normal
Scan Profile: Normal Digital
Scan the currently selected socket (Socket 2) and compare to a saved PinPrint
Scan
Status: SUSPECT
Scan Step: 1 of 1
Scan Mode: Single
Compare Scans
Comparison Type: ○ None ○ Socket ● Saved
Comparison Master:

| Date | Description | Profile |
|---|---|---|
| 26/01/2009 | OKI Reference | Normal Digital |
| 26/01/2009 | Master Data | Normal Digital |

Zoom x 4.20

Edit Package Fixture - [New Package Fixture]
Grid size: 0.250 ● mm ○ in ☑ Show grid ☑ Snap to grid ● Channel numbers ○ Pin numbers
Zoom x 6.78
Selection Tool
Click and drag to select and manipulate components.
The properties of selected components will be editable in this panel.
Package Fixture Details
Description:
Scan Step: 1 of 2
Step Prompt:
Label at (19.3, 3.5)mm, size 11.0 x 3.0mm | Mouse: (29.913, 0.000)

*Software screenshots*

**SENTRY** is a practical and affordable solution for solving the counterfeit IC issue, using its rapidly-built dedicated library of component data to cross-check each part tested. With lead-time issues making ICs harder to acquire to meet aggressive manufacturing schedules, identifying any parts that are not “real” before they enter production can potentially save every manufacturer a great deal of time and money – and that intangible but irretrievable quality – brand reputation.