Battelle Barricade™
Electronic Component Authentication Technology
Battelle - Serving a Broad Range of Clients

- Consumer & Industrial
- Energy & Environment
- Health & Analytics
- Laboratory Management
- National Security
- Pharmaceutical & Medical Devices
- STEM Education
National Security

- Advanced Manufacturing & Design
- CBRNE Defense
- Critical Infrastructure
- Cyber Innovations
- Data Analytics
- Demilitarization
- Identity Management
- Life Sciences Research
- Maritime Systems
- Medical Readiness & Response
- Tactical Systems
Electronic Component Authentication as an Anti-counterfeiting Tool: Battelle Barricade™

The Problem

• Counterfeits in the supply chain: ranging from primitive chip harvesting to sophisticated cloning
• Weaponized hardware

The Solution

• Nondestructive classification based on the effect of environmental exposure and systematic manufacturing variations have on the electrical characteristics of components (classifying on similarities and not anomalies)

Why it matters
What is Battelle Barricade™ and how does it work?

To secure authentication process
To protect customer proprietary info

USER/PART FINGERPRINT
- Power Consumption Waveform
- Waveform Serialization ID
- Part # & Lot/Date Code
- Customer & Acquisition System ID
- Date/Time Stamp

Customer Sites
- OEM pre-assembly verification
- OCM brand protection and QA
- Component distributor validation
- Maintenance and repair depots
- Critical points in supply chain for chain of custody assurance
- Forensic laboratories

Collected for each device
Enrolled Components from Customer Bill of Materials
How good are the results?

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Class (family)</th>
<th>Subclass (temp. grade)</th>
<th>ID</th>
<th>Notes</th>
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<tbody>
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**True Class Identification**

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</tbody>
</table>

TP: true positive (classifies an authentic part as authentic)

FP: false positive (classifies a counterfeit part as authentic)

Power Consumption Waveform → Featurization → PCA → kNN
**How good are the results?** Tests performed on SMT supplied parts

<table>
<thead>
<tr>
<th>Component</th>
<th>Test Description</th>
<th>Classifier Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-bit decoder DM74LS138N (FAIRCHILD, NATIONAL)</td>
<td>25 authentic samples from each of 4 different manufacturers having the same part number</td>
<td>95% Discriminating manufacturers</td>
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<tr>
<td>SN74LS138N (MOTOROLA, TI)</td>
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<tr>
<td>hex Schmidt inverter CD40106 (TI)</td>
<td>10 samples each of authentic and cloned components</td>
<td>100% Discriminating authentic and cloned parts</td>
</tr>
<tr>
<td>windowed EPROM M2732A-2F1 (ST MICRO)</td>
<td>10 samples each of authentic and counterfeit parts</td>
<td>100% Discriminating authentic and counterfeit parts</td>
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<tr>
<td>quad NAND gate SN74S00N (TI)</td>
<td>10 authentic samples each of 4 different date/lot codes from the same manufacturer</td>
<td>80%-90% Discriminating date/lot codes</td>
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<td>8 bit shift register SN74HC164N (TI)</td>
<td>15 authentic samples and 16 clones</td>
<td>100% Discriminating authentic and cloned parts</td>
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<td>multichannel transceiver MAX232CPE (Maxim)</td>
<td>4 authentic samples and 7 clones</td>
<td>100% Discriminating authentic and cloned parts</td>
</tr>
</tbody>
</table>
Battelle Barricade™ Summary

Attributes

- Nondestructive
  - Authenticate 100% of component inventory except for training samples if from an untrusted source
- Nonintrusive
  - No chip design modification or physical alteration
  - No insertion of technology into the manufacturing process of a trusted source
- High confidence/reliability
  - True positive (classifies an authentic part as authentic) goal of >95%
  - False positive (classifies a counterfeit part as authentic) goal of <1%
- Simple to use graphical user interface
- Low cost per part (pennies per part)
- High throughput rate (<< seconds per part)

Classifier Component Discrimination

- Authentic parts by part number, manufacturer, country of origin, temperature grade, date/lot code,…)
- Counterfeits
  - Die substitution
  - Age and environmental exposure
  - Temperature grade remarking
  - Clones
- Hardware Trojans

Authenticated Components and Counterfeits/Clones Data Repository