

# **COUNTERFEIT COMPONENTS AVOIDANCE PROGRAM, CERTIFICATION FOR**

**Purpose:** Establishing standard procedures for the authentication of electronic components, integrated circuits, hybrid microcircuits, semiconductors, transistors, diodes, capacitors and resistors, thereby decreasing the risk of counterfeits entering a customer's supply chain.

## **1 Scope**

This document describes a Certification Program for the detection and avoidance of counterfeit components supplied by Independent Distributors (ID). Implementation of this Program is mandatory for IDs to become Certified to CCAP-101 for Counterfeit Components Avoidance. The ID Procedures are designed for components purchased from the open market, not from OCM or Franchised Distributor (FD) and shall address both commercial electronic components and military electronic components and applies only to new components, which have never been installed on circuit boards or in equipment. The Certification Program provides for a choice of Level A (which includes electrical testing) or Level B (which excludes electrical testing except for specified passives). The customer must specify the level A or B to be supplied.

*The CCAP-101 Certification Program is trademark and copyright protected by Component Technology Institute, Inc. (CTI) and shall only be used with the approval of CTI Inc.*

***Counterfeit Electronic Component, as used in this document, refers to any component which violates any intellectual property rights, trademark or logo, is not new or is not authentic to the requirements of the manufacturer part number ordered by the Customer.***

### **1.1 Introduction**

Counterfeit Electronic Components are causing major problems in the electronics industry. The problems affect production, warranty costs and safety of aerospace, military, medical electronics and many forms of consumer electronics. The safest way to avoid counterfeit components is to purchase them from the Original Component Manufacturer (OCM) or through their franchised (FD) or authorized distribution (AD) supply chain. This is usually not possible when the Original Component Manufacturer has discontinued the component production, when components are on allocation, or when lead times exceed customer requirements.

This CCAP program was created to provide practices suitable to detect electronic components that are not new and authentic. This Program allows users of electronic components to order components from Certified IDs with a higher confidence of being free of counterfeits. CTI provides this Certification service as an unbiased and independent organization, which is not involved in the buying or selling of electronic components.

IDs shall establish procedures to implement CCAP-101 requirements, which CTI will evaluate prior to the Certification Audit. The ID or Customer does not have the authority to alter, delete or change these procedures. If they do, the components shall not be delivered as Certified to CCAP-101. The customer may add additional electrical tests, tape and reeling, other packaging, device programming, BGA re-balling, etc. after authenticity has been proven, but shall not alter or delete any of the Program requirements specified herein. Components shall be processed through the CCAP-101 inspections and tests until it is determined that they are or are not authentic per the Level A or B Certification that is ordered.

### **MANDATORY ELEMENTS OF CERTIFICATION PROGRAM**

1. CTI review and approval of ID inspection procedures for conformance to CCAP-101
2. CTI audit of ID avoidance practices
3. Purchasing practices by ID
4. Supplier documentation inspection
5. Component visual inspection, sampling and testing for remarking
6. X-Ray inspection

7. XRF test of leads
8. De-cap and die inspection of samples (discrete semiconductor and IC components)
9. Electrical test of passive components (Both level A and B)
10. Electrical test semiconductors and ICs , Level A only
11. Selection and control of contract test labs
12. Counterfeit Avoidance Inspection Report
13. E-Documentation and retention of data specified
14. Supply of inspection results summary and Level A or B Certificate of Conformance to the customer with the parts.

When an inspection sample fails any required inspection, at any stage of the inspection process, the lot shall be classified as Counterfeit and shall not be considered further for acceptability.

IDs whose Practices are audited and then determined by CTI, Inc. to be in compliance, will be Certified to deliver components in conformance to this Program. This Program applies to discrete semiconductors, integrated circuits, hybrid microcircuits and passive components procured in the open market rather than from OCM or FD.

## **1.2 Intellectual Property Ownership**

This Certification Program Document and the granting of Certification to the Requirements thereof are the Intellectual Property and under the sole ownership of Components Technology Institute Inc. (CTI Inc.) and are protected by Federal Trademark Registration and Copyright. A claim to be in compliance with CCAP-101 Program without being certified by CTI is in violation of the Federal Trademark and Copyright laws. Components shall not be identified or delivered by any seller as in compliance or conformance with CCAP-101 Program by any seller that is not currently Certified to these requirements by CTI, Inc.

## **2 Reference documents**

The following specifications and standards of the latest issue, revision or amendment, form a part of this document to the extent specified herein.

ANSI/ESD S20.20-2007, Development of an Electrostatic Discharge Control Program  
ANSI/NCSL Z540-1, Calibration Laboratories and Measuring and Test Equipment – General Requirements  
AS5553 Counterfeit Electronic Parts, Avoidance, Detection, Mitigation and Disposition  
IPC/JEDEC J-STD-033, Standard for Handling, Packing, Shipping of Moisture Sensitive Surface Mount Devices  
ISO - 9001, Quality Management Systems Requirements  
JEDEC J-STD-020, Moisture Sensitivity Classification  
JEDEC STD 22-B102E, Solderability  
JESD22-B107C, Marking Permanency  
JESD22-B108A, Coplanarity Test for Surface Mount Semiconductor Devices  
JEDEC J-STD-033, Handling, Packing, Shipping – SMT Devices  
QML- 38535, Qualified Manufacturers List for Integrated Circuits to MIL-PRF-38535  
QML-19500, Semiconductor Devices Qualified to MIL-PRF-19500  
MIL- HDBK-103 List of Standard Microcircuit Drawings  
MIL- PRF-38534, General Specification for Hybrid Microcircuits  
MIL- PRF-38535, General Specification for Integrated Circuits Manufacturing  
MIL- PRF-19500, General Specification for Semiconductor Devices  
MIL- STD-750, Test Methods for Semiconductor Devices  
MIL- STD-883, Test Method Standard Microcircuits  
MIL-STD-1835, Electronic Component Case Outlines

## **3 General requirements**

### **3.1 Definitions**

The following definitions apply to CCAP-101 Program.

### **3.1.1 CTI Inc. – Components Technology Institute Inc.**

#### **3.1.2 CCAP-101 Certified**

The CTI Inc. document, which describes the program requirements to be utilized by Independent Distributors, selling electronic components as certified to the Counterfeit Components Avoidance Procedures.

#### **3.1.3 ID Approved Supplier**

A supplier the ID has approved, to perform specific requirements, for the supply of components processed for delivery as CCAP-101 Certified.

#### **3.1.4 Suspect Components**

A component, in which there is an indication that it may have been misrepresented by the supplier and appears to meet the definition of counterfeit but cannot be authenticated to OCM markings. Suspect components shall not be delivered as Certified to CCAP-101.

#### **3.1.5 Counterfeit Component**

A component that has been confirmed to be a copy, imitation, fake, is represented as new and unused or markings have been altered. All components that cannot be authenticated through test & inspection shall be treated as counterfeit.

#### **3.1.6 Aftermarket Supplier or Manufacturer**

A manufacturer or supplier that is authorized by OCM to produce and/or sell components, manufactured or assembled, which have been discontinued by the OCM. The aftermarket manufacturer must label or otherwise identify components they assemble or manufacture to ensure component will not be mistaken for the item produced by the OCM.

#### **3.1.7 Authorized Distributor (AD)**

Supplier of authentic components in accordance with the terms of an OCM contractual agreement.

#### **3.1.8 Broker (distributor)**

A type of Independent distributor that finds needed components for customers but do not have contractual agreements or obligations with the OCM.

#### **3.1.9 Certificate of Conformance (C of C)**

A document provided by the OCM or AD formally declaring that all buyer purchase order requirements have been met. The document may include information such as OCM, distributor name, quantity, lot and/or date code, inspection date, etc., and is signed by a responsible employee designated by the Supplier's management.

#### **3.1.10 C of C for Military Components**

A certificate of Conformance required by certain military specifications which requires documented supply chain traceability from the Qualified Products List/Qualified Manufacturers List (QPL/QML) manufacturer through delivery to a government agency or OEM/customer when the material is not procured directly from the OCM/AD.

#### **3.1.11 Decapsulation**

Process by which the internal construction is exposed to check for characteristics that indicate the component is authentic to the named OCM.

#### **3.1.12 Franchised Distributor (FD)**

For the purpose in this Program, Franchised distributor is considered synonymous with Authorized Distribution for the OCM.

#### **3.1.13 Homogenous Production Lot**

A group of components that:

- A. Is received in a single shipment (whether in single or multiple packages)
- B. Is marked or otherwise identified with identical, dates codes, lot codes, etc.
- C. Exhibit identical appearance to the unaided eye (parts and packaging)
- D. Appear to have been subjected to the same handling, packaging, and/or storage conditions
- E. Have maintained their physical placement relative to each other for delivery

### **3.1.14 Independent Distributor (ID)**

A distributor that purchases parts with the intention to sell and redistribute them back into the market. Purchased parts may be obtained from OCM/AD, Original Equipment Manufacturer (OEM) or Contract Manufacturers excess inventories, or from other Distributors (Franchised, Authorized or Independent).

### **3.1.15 Known Authentic Part**

A part, which has either been purchased directly from the manufacturer, their authorized distributors, authenticated by the OCM with supporting documentation or through test and inspection.

### **3.1.16 Nondestructive Testing (NDT)**

Various tests and inspections that have been proven to be nondestructive to the components performance or reliability.

### **3.1.17 Original Component Manufacturer (OCM)**

A company that designs and is responsible for the manufacturing of the component and owns or controls the intellectual property rights of the product.

### **3.1.18 Original Equipment Manufacturer (OEM) or Contract Manufacturers (CM)**

A company that manufactures equipment or systems that utilizes electronic components.

### **3.1.19 Reclaimed or Refurbished**

Components that have been reclaimed, refurbished in an effort to restore them to a "like new" condition, e.g., and leaded parts that have leads realigned, re-tinned, subjected to cleaning agents and chemical processing and shall not be delivered as CCAP-101 Certified. *(Customer may request terminations be retinned after components are accepted to CCAP-101. This will void future conformance to CCAP-101)*

### **3.1.20 Semiconductors**

Semiconductors as used herein include all discrete transistors, diodes and integrated circuits (ICs).

### **3.1.21 Used Components**

Components that have been electrically tested by other than OCM or their contract test labs or subsequently pulled or removed from a socket or other electronic application. These components cannot be delivered as CCAP-101 Certified.

## **3.2 Agreements**

All IDs certified to these requirements by Components Technology Institute Inc. (CTI) agree that all components sold and delivered as Certified to this Program have been subjected to all the requirements stated **herein** and that they have performed the required due diligence to avoid the delivery of counterfeit components. CCAP-101 Certified components shall not be supplied to other IDs. Neither the ID nor the Customer have the authority to change, modify or delete any of the specified component authentication practices specified herein. By mutual agreement the customer and ID may specify additional services such as electrical tests, tape & reeling, reballing BGAs, programming etc. after the authenticity of components has been established. The delivery of CCAP-101 Certified components from lots or sub-lots not subjected to these requirements is prohibited. A single verified shipment of counterfeit components shall result in immediate suspension of the ID's Certification and no further delivery of Certified Components shall be made until the issue is resolved to the satisfaction of CTI Inc. and the ID's Certification is reinstated.

### **3.2.1 Industry counterfeit avoidance standards**

This Program is designed to meet the objectives of AS5553 to detect and avoid counterfeit electronic component purchased from IDs.

### **3.3 Warranty**

Components that are inspected, tested and delivered by the selling ID, whether the verification is performed in house or by a contract laboratory to this Certification Program, shall be fully warranted by the ID for one (1) year minimum to be authentic to the Original Component Manufacturers (OCM) data sheet or military specifications, as applicable. This warranty is limited and provides that the components are authentic to the data sheet or specification that were ordered by the customer. This includes OCM quality issues that are reasonably detectable during the authentication processes required by CCAP-101.

### **3.4 Quality system**

The ID shall establish and maintain as a minimum a documented quality system that conforms to ISO 9001 and the additional requirements of this document. Customers may add additional quality system standards to meet their needs. The ID's quality system and counterfeit avoidance procedures are subject to review and analysis with appropriate notice by the customer representative and/or authorized Government representatives. This includes surveillance of products, systems, procedures, facilities and records associated with components they have purchased. The responsibility for quality functions and counterfeit avoidance procedures shall be clearly identified within the ID's organization. Personnel performing these functions shall have sufficient authority and independence to evaluate the problems and to initiate and recommend corrective action.

### **3.5 Procedure control**

The ID shall establish and maintain a system to control and distribute the procedures that implement the requirements of this document.

### **3.6 Records**

All records shall be in accordance with ISO 9001 or equivalent and this document.

1. Written Records - All handwritten entries shall be in ink.
2. Incorrect Entry – The only acceptable error correction method for handwritten entries is to line out the incorrect entry with a single line, add the new information, the date of correction and initial the new entry. Any obliteration of data, use of correction fluid or tape, or erasers for corrections is not permitted on any record including but not limited to: lot travelers, calibration records, or the Certificate of Conformance.
3. Record Retention and Retrievability - The ID shall document and maintain all inspection records for at least five (5) years for both Commercial and Military components. These records shall be readily retrievable by part number, OCM's name, customer's name, PO and status.
4. The inspection and tests performed for this Program shall be reported on the forms contained herein with accuracy and detail to permit analysis by the ID's internal quality representative, customer auditor, CTI, Inc. and Government organizations.
5. Records and photographic evidence of any counterfeit components detected shall be maintained for future retrieval and reference.

### **3.7 Inventory control**

The ID shall have a system for controlling inventory of CCAP-101 certified product.

1. The inventory management system must provide for segregation by part number and level A or B Certification.
2. There shall be an effective system for the legal disposition of counterfeit components and control of nonconforming product. The system shall provide for the identification, segregation and disposition of these nonconforming products and preclude their shipment or reentering the supply chain.
3. The inventory shall be maintained in a local locked storage area with limited access.

### **3.8 Electro-static discharge (ESD) - Safe handling procedure**

The ID's system for electro-static discharge sensitive (ESDS) components protection shall be in compliance with the latest revision of ANSI/ESD S20.20 with periodic verification and testing of ESD suppression and detection equipment.

### **3.9 Receiving, inspection, storing, packing, and shipping products**

The ID's receiving, inspecting, storing, packing and shipping procedures shall prevent mechanical or electrical damage and degradation of the components in their possession. All packing materials shall be either conductive or antistatic, including tubes, trays, reels, bags, and fillers. Procedures for the handling, storing, re-baking, re-bagging and shipping of moisture/reflow sensitive devices, which have been classified to the levels defined in J-STD-020, shall ensure that the methods used maintain compliance with J-STD-033. The ID shall be responsible for verifying conformance to all the processing, packing, labeling and ESD requirements prior to shipping components from their facility.

### **3.10 Inspection, test status and traceability**

The ID shall provide a means to identify the authentication inspection status of all components throughout inspection, handling, processing, and storage. This may be accomplished through the use of inspection sheets, tags, routing cards or other control devices that are attached to, or travel with, the product.

1. The method of indicating the person performing a function shall be controlled and allow for easy status determination (e.g., stamps, signatures, electronic identification). A personnel list shall be kept current for all stamps or initials and the log of status shall be available to the auditor for inspection and verification of names upon request.
2. When operators or inspectors use signature or initials in lieu of stamps on processing records the signature/initials must be on record, legible and traceable.
3. No marks or alterations shall be applied to the components.

### **3.11 Calibration of equipment**

The ID and their approved contract laboratories shall calibrate and maintain all inspection, measuring and testing equipment that is used for authentication or counterfeit detection activities in accordance with ANSI/NCSL Z540-1, whether owned or leased, by the ID or sub-contractor. Repair and calibration records shall be maintained in accordance with the provisions of ANSI/NCSL Z540-1.

### **3.12 Customer returns**

Components returned to the ID from a customer shall be quarantined until they can be inspected for any evidence of alteration, mishandling or improper packaging. Components returned as being counterfeits shall be quarantined in a locked secured area until they can be investigated to determine their authenticity or lack thereof. Upon determination that the components are authentic, they may be dispositioned back into stock with documentation including, at a minimum, the stamp or signature of the inspector(s), the completed inspection records, and a system that retains this record for a minimum of 5 years. **CTI Inc. shall be notified within 3 business days for investigation of the counterfeit claim and contributing conditions, and the components shall remain in quarantine until the investigation is complete. The ID shall not deliver any components as CCAP-101 Certified until the investigation and corrective action is complete.**

### **3.13 Training**

The ID shall identify the training needs and provide for the training of all personnel in the proper handling of components and performing the authentication & counterfeit detection procedures required for this Program. This training shall be completed before the Certification is performed by CTI, Inc. Individuals shall be retested and/or retrained a minimum of once per year, when procedural changes occur, or when personnel performance indicates poor proficiency resulting in the shipment of components found to be counterfeit by a customer. The adequacy of personnel training to the ID's Counterfeit Components Avoidance Practices will be assessed by CTI, Inc. during the certification audit and when conditions warrant.

Training records shall be maintained for at least three (3) years, detailing the nature of training, date, length of training, personnel receiving the training and the name of trainer.

### **3.14 Certification audits and approvals**

A non-certified ID shall not claim compliance to the CCAP-101 Program, which is protected by "Copyright and Trade Mark" and for which use must be approved by CTI. Only Components Technology Institute Inc. personnel have the authority to audit and grant Certification to IDs that comply with these Requirements for the detection and avoidance of counterfeit components and the use of CCAP-101. The ID is responsible for assuring that their personnel constantly follow these practices and shall conduct internal audits as necessary

and a minimum of once every twelve months to verify compliance with the requirements of this document. The audit frequency within these limits shall be based on results of previous audits.

1. The results of the audits shall be documented and conveyed to the attention of the personnel having responsibility in the area audited, timely corrective action shall be taken, and a record of those corrective actions shall be maintained.
2. Corrective actions implemented as a result of audits and customer complaints shall be documented, including actual implementation dates.
3. A formal procedure for verification of corrective action effectiveness shall be in place.
4. The audit reports, corrective actions, and verification reports shall be available for review upon request.
5. Customer representatives may visit the ID's facility to review conformance to this standard for components they have ordered. The ID shall provide the necessary information, facilities and assistance for these reviews. Any noncompliance noted will result in corrective action by the ID and reported to the CTI Inc. for investigation. Failure of ID to conform to the CTI Inc. Certified Counterfeit Components Avoidance Practices may result in loss of certification, preventing further shipment of Certified components to customers.

### **3.15 ID location**

The ID shall identify the location where Certified Components are inspected, tested and processed pursuant to the Counterfeit Components Avoidance Program. The ID shall identify and provide to CTI all subcontractors and their services, which are used to determine component authenticity. The ID shall assure their subcontractors services conform to the applicable requirements of the IDs approved Procedures as if the performance was in house. The ID is solely responsible for the subcontractors testing and inspection results. A Certified ID that has Certified operations outside USA shall not deliver CCAP-101 certified components to any customers in North America without being processed by the USA Certified location.

### **4.0 Detail requirements**

The detail inspection and test requirements for this Program are contained in this section. A summary of the equipment to perform the inspections and tests is shown in Table 1.

#### **4.1. Sources of supply**

The ID shall have a documented and formal procedure for selecting, approving and monitoring their suppliers, such as: The suppliers past performance in avoiding the supply of counterfeit components, business practices, liability insurance, financial stability, controls over their suppliers, practices for avoiding counterfeit components, ESD Certified handling practices and other useful controls.

The following terms and conditions shall be imposed on all suppliers of components purchased for supply as Certified Components to the Requirements of this document:

- A. New and never installed components are required.
- B. Component markings must be OCM original with no indication of change, alteration or additions unless there is an OCM Certification to prove that the parts were remarked by the OCM.
- C. Allow adequate time, a minimum of 30 days from receipt, to verify authenticity of the components supplied.
- D. When components are proven counterfeit, the components will not be returned to the supplier regardless of payment terms, and the components will be legally disposed of. The supplier is entitled to a copy of the report proving components are counterfeit and up to 5 samples for verification.
- E. Traceability data for components to all previous suppliers shall be provided where available.
- F. Military and space specification marked components shall not be sourced from China, India, Africa or other areas of the world known to supply counterfeit military components except from the OCM or their Authorized Distributors.
- G. A Certificate of Conformance shall be provided by the Seller to the ID certifying the components are authentic to the component markings.

#### **4.2 Microscope inspection equipment and technique**

The ID shall utilize microscope equipment suitable to examine components for external package marking and conditions indicative of counterfeiting.

##### **4.2.1 Microscopist qualifications**

The microscopist shall be sufficiently trained on the equipment used and to be able to distinguish normal package external variations from the manufacturer's quality problems and from counterfeiting. The microscopist shall be trained to recognize the type of illumination, which is best for the detection of defects indicative of counterfeiting. The inspector shall not be visually impaired or color blind.

#### **4.2.2 Microscope inspection - low-power**

The microscope shall be a binocular microscope with step-adjustable or continuously-variable magnification for external package examinations at magnifications ranging from 3X to approximately 30X at the eyepiece and shall be of sufficient quality to produce color-correct, aberration-free, well-focused images. A specimen table with X & Y axis movement shall be used to position the component during inspection. Sample illumination shall be with suitable lighting for the area of inspection, adjustable incandescent white or LED lights, or both. Vertical and oblique illumination shall be used to highlight surface detail. Lighting shall be adjusted to suitable intensity and variable inclinations with respect to the axis of the lens to highlight sanding or grinding striations

*Note: Caution is advised to avoid illumination with sources having blue-white LED's, rather than white LED's, as the former produce an undesirable color shift in the final image.*

#### **4.2.3 Microscope inspection – high-power**

A binocular metallurgical microscope with variable magnifications obtained through a three-lens system or equivalent is required for die photography after decapping or decapsulation. The magnifications shall cover a range from 30x to 400x and the optics shall provide a high quality image suitable for verifying die markings. Through-the-lens lighting of sufficient intensity shall be used to give a high quality image. A polarizing filter shall be used to highlight detail and minimize reflective glare during inspection and die photography. Samples shall be lighted evenly, without overexposed spots, streaks, or reflections. The sample shall be leveled on the microscope x, y & z axis stage to assure that the resulting images are in focus across the photograph and there is no keystone effect.

#### **4.2.4 Digital photography**

Digital cameras, including handheld digital cameras suitable for low-magnification photos, used in conjunction with microscopes that have a resolution 3 Mpx minimum for image capture to avoid pixilation, sawtooth, herringbone, Moire patterning, etc., which can interfere with the information to be conveyed in the photo. Digital photos shall be made on a minimum of 3 representative samples at appropriate magnification and shall be a true representation of these characteristics:

- A. Component external package & leads
  - Full frame of entire device including the leads with upright orientation to read markings.
  - Top and bottom of package and, a side (edge) view.
  - Compare surface of top and bottom of 2 parts for the same appearance within the same frame.
  - Before and after marking permanence and acetone test.
  - Sharply focused with adequate depth of field.
  - Indications of blacktopping, overcoating or remarking.
  - Lead conditions indicative of reclaim or previous use.
  - Hi mag of the end of leads or for retooling.
  - Hi mag of the end of leads demonstrating typical lead shear marks
  - Uniform lighting, no overexposure, shadows or washout of features.
  
- B. Component external package & leads
  - Full frame of entire device including the leads with upright orientation to read markings.
  - Top and bottom of package and, a side (edge) view.
  - Compare surface of top and bottom of 2 parts for the same appearance within the same frame.
  - Before and after marking permanence and acetone test.
  - Sharply focused with adequate depth of field.
  - Indications of blacktopping, overcoating or remarking.
  - Lead conditions indicative of reclaim or previous use.
  - Hi mag of the end of leads or for retooling.
  - Hi mag of the end of leads demonstrating typical lead shear marks
  - Uniform lighting, no overexposure, shadows or washout of features.



| <b>Table 1. CCAP - 101 INSPECTION &amp; EQUIPMENT LIST</b>    |   |                                      |
|---|---|--------------------------------------|
| <b>1. Microscopes</b>   |   | <b>Refer Paragraph</b>               |
| Low Power   | Binocular with 3x to 30x magnification  | 4.3.2.2                              |
| Hgh Power   | Binocular with 30x to 400x mag. With long focal length<br>Polarizing filter<br>Light field, dark field  | 4.3.2.3                              |
| Lights  | Ring Lights<br>Adjustable intensity, vertical and inclineable<br>LED  |                                      |
| Digital Cameras   | 3 mp minimum<br>Through the lens<br>Macro capability  | 4.3.2.4                              |
| Specimen Holder   | X, Y, Z axis Each microscope  | 4.3.1.1<br>4.3.2.3                   |
| <b>2. Support Equipment</b>                                   | ESD finger cots or gloves<br>Tweezers<br>Vacuum pick-up<br>Bar scanners/readers<br>Micrometer or calipers<br>Scales                           | 4.3.1.1                              |
| <b>3. Marking Alteration</b>                                  | Marking permanence<br>Acetone   | 4.4.1 - 4.4.3                        |
| <b>4. Heated solvent test (HST) *</b>                         | N-meth-P<br>Dynasolve 2000<br>Other appropriate solvent   | 4.4                                  |
| <b>5. X-ray*</b>  | Capability for individual, tray, tube or reel<br>Variable voltage - 60-120 KV current<br>High resolution<br>Variable magnification up to 400X | 4.6, 4.7 - 4.7.2                     |
| <b>6. XRF*</b>  | 1 mil spot size preferable  | 4.7, 4.8.1                           |
| <b>7. Solderability Testing*</b>                              |   | 4.7.2                                |
| <b>8. Decap - Hermetics*</b>                                  | Can opener<br>Jewelers saw<br>Side cutters  | 4.8                                  |
| <b>9. Decap PEMs*</b>   | Automatic acid decap equipment<br>Manual acid decap<br>All safety equipment & training  | 4.8                                  |
| <b>10. Electrical Test*</b>                                   | IC's<br>Discrete semiconductors<br>Passives   | 4.9.5, 4.9 - 4.9.3<br>4.9.4<br>4.9.6 |
| * These tests may be contracted to an ID's Approved Test Lab. |   |                                      |

- C. Component external package & leads
  - Full frame of entire device including the leads with upright orientation to read markings.
  - Top and bottom of package and, a side (edge) view.
  - Compare surface of top and bottom of 2 parts for the same appearance within the same frame.
  - Before and after marking permanence and acetone test.
  - Sharply focused with adequate depth of field.
  - Indications of blacktopping, overcoating or remarking.
  - Lead conditions indicative of reclaim or previous use.
  - Hi mag of the end of leads or for retooling.
  - Hi mag of the end of leads demonstrating typical lead shear marks
  - Uniform lighting, no overexposure, shadows or washout of features.
  
- D. Die photos
  - Full frame of die, sharply focused and with square orientation.
  - Good focus and magnification to illustrate major functional blocks or metallization pattern and markings such as date, logo, mask numbers, alignment keys, etc, referenced to a low-power "location" photo of the entire die.
  - Uniform lighting across the die or field of view.

Once the image is captured, it may be rotated, cropped, reformatted, darkened or lightened, etc., to enhance the image. Enhancements, if any, shall be made without altering the fundamental information contained. Images incorporated into electronic reports should avoid excessive file size, as they expand the document size to the point that they are cumbersome and cannot be sent via email. Image capture should be Joint Picture Expert Group (JPEG) formatting. Images should be cropped to reduce file size due to extraneous background content.

#### **4.2.5 Support Equipment**

The listed support equipment shall be available and used when appropriate to properly perform these inspections.

- ESD finger cots or gloves
- Tweezers
- Vacuum pen
- Micrometers or calipers
- Bar scanners and readers

#### **4.3 Initial inspection**

The following shall be performed upon opening the package containing the components:

- A. Components are received in single shipment.
- B. Components are marked or otherwise identified with identical lot, run, and identification information (e.g., date codes, lot codes, and serial numbers). If multiple date codes are observed, follow the criteria defined in 4.2.6.3 Test/Inspection Sampling Plan for the handling of multiple date codes.
- C. All parts are identical in appearance to the unaided eye (parts and packaging).
- D. Do any components appear to have been subjected to different handling, packaging, and/or storage conditions.
- E. Any signs the components came from different sources, labeling, etc. (i.e., have never been separated based on evidence such as source, packaging, labeling).
- F. Printed matter, labels, shippers, inventory documents etc. shall be checked for correct spelling, font consistency and other characteristics, which if different from those used by the OCM characteristics detected in packing may indicate the components are suspect Counterfeit.
- G. Check moisture sensitivity card by cutting and inserting half in water to see that it registers correctly per JEDEC –J-STD-033.

##### **4.3.1 Visual inspection and sampling**

When the shipping quantity is for 50 components or less, 100% of the components shall be visually inspected. When the shipment is more than 50 components, sample inspection as stated herein may be used, provided

the components are a homogenous lot or sub-lot. Any variation in markings, different date codes or lot numbers, different country of manufacture or other detectable differences, such as reversed placement in tapes, shall be used to establish that the components are not from a single homogenous manufacturing lot. When it is determined that the lot is not homogenous, the total shipment shall be rejected or divided into sub lots, as determined by the characteristic(s), which are different or rejected as counterfeit when characteristics violates inspection criteria. When these sub-lots contain less than 50 components, they shall be 100% visually inspected. For lots and sub-lots with more than 50 components a minimum of 50 pieces per 1000 pieces of fraction thereof shall be inspected. One or more rejects for a counterfeit characteristic shall result in rejection of the entire population represented by the sample as counterfeit components. Suspect components and randomly selected components shall be selected from throughout the population. When components are on tape and reel, a minimum of twenty 20 components shall be randomly selected for each 1000 pieces or fraction thereof from throughout the reel for inspection and removed for inspection of all specified characteristics. After inspection the components may be reinstalled in the tape in conformance with industry practices.

#### **4.3.1.1 Cleanliness**

Samples shall be clean of all extraneous foreign material such as fibers, hairs, mounting clay fragments, grinding particles, glue overflow, fingerprints, chips, tool scratch marks, spittle, dust, etc. These are some examples of such foreign material that would distract from or confuse the inspection or photographic image. Samples shall be oriented correctly and sensibly to minimize chances of confusion and misinterpretation. In the case of high-magnification images, an "orientation" image at low power shall be used to show the location of the region that contains the die number being examined in detail.

*(Note: Packing material properties, such as foreign language newspapers, peculiar odors, or color and texture of cardboard, can be an indication that the components are from China).*

#### **4.3.2 Detail visual inspection**

This procedure requires the inspection of components on a 100% or sampling basis as specified herein. The samples shall be optically examined at magnification and lighting sufficient to detect the particular feature being examined. Anomalies must be resolved or components rejected as counterfeit. These suspect observations shall be documented in the final test report. Verify the following against the applicable device specification or manufacturer's datasheet. Characteristics, not applicable or observable for the component design or configuration, are not required to be performed.

##### **A. Package Inspection**

1. Correct package type and leads
2. Part dimensions (measure minimum of 3 pcs and record readings)
3. Verify pin 1 and placement in tray, stick or tape and reel
4. Significant package variations with the same date/lot codes
5. Uneven thickness depth
6. Signs of blacktopping or clear coating plus dimples with uneven depth
7. Visible sanding or random scratch marks or random abrasion
8. Differences in the corner radius between the top and bottom of the part
9. Color discrepancy between the top and bottom of the part
10. More than one part number in the lot
11. Mold mark interiors are not smooth or indentions are missing;

##### **B. Component markings for signs of remarking or counterfeiting**

1. Different marking styles for parts with the same date/lot code
2. Different country of origin for parts with the same date/lot codes
3. Different body molds for parts with the same date/lot code
4. Different backside markings or surface appearance for parts with the same date/lot codes
5. Previous marking partially visible on the surface
6. If available, compare part logo(s) to a part received from the OCM or OCM-approved Authorized (Franchised) Distributor
7. Date codes that contradict OCM end of production information on components
8. Date code impossible, such as week 57;
9. Lot code, incorrect or missing a character

10. Marking is crude, amateurish, mixed fonts, mixed "0" and "O";
11. Marking fails permanency, acetone, scrape, or heated solvent tests
12. Difference in color/texture of package top, bottom or side wall adjacent to the leads
13. Other characteristics not consistent to OCM named on component.

C. Lead condition:

1. Bent or non-planar leads
2. Excessive or uneven plating, solder or bumpy solder
3. Missing pins
4. Non-uniform thickness of leads or plating
5. Tool marks other than forming tool marks
6. Lack of exposed base metal at the lead tip from shearing
7. Discoloration, dirt, or residues on the leads
8. Scratches on the inside and outside faces of the leads
9. Corrosion or gross oxidation
10. Plating and coverage matches OCM data sheet
11. Co-planarity of SMT components per JESD22-B108A or suitable alternate procedure as stated in ID Procedure
12. Transistor outline cans (TO-5, TO-18, etc.) shall be subjected to two 90° lead bend 5 cm below the header to test for lead extensions.

D. BGA packages condition and interconnects:

1. Scratches in the mask that run underneath a solder sphere
2. Solder on exposed plating away from the solder spheres
3. Solder mask damage
4. Debris or residue between the solder spheres
5. Solder dross on the solder mask
6. Solder mask touchup or repair
7. Other signs of re-balling

E. CGA columns and BGA ball interconnects:

1. Discoloration, dirt, or residue on solder spheres or columns
2. Crushed or flattened BGA solder spheres
3. Misaligned columns
4. Discolored solder spheres or columns
5. Non-uniform size and shape of solder spheres

F. Passive Components:

1. Marking matches OCM data sheet
2. Check and record dimensions on 10 pcs/1000 minimum
3. Packaging matches OCM's
4. Unmatched components must be electrically tested per 4.9.6
5. Marked and non-OCM packaging

#### 4.3.3 Commercial components

Commercial components shall be verified to the OCM's specifications and data sheets for all observable characteristics to establish authenticity. Non-conforming characteristics shall be listed in the inspection report with photos and graphics demonstrating counterfeits and referencing them to the data sheet characteristics. Any samples that fail to meet these inspection criteria shall classify the component population they represent as counterfeit and shall all be rejected.

##### 4.3.3.1 Moisture sensitive components.

Components that are moisture/reflow sensitive shall be controlled to the OCM specified level. MSL requirements shall be verified on the OCM specification sheet when components are received. The MSL card shall be tested for authenticity by cutting in half through the moisture sensor and one half inserted in water. When this half shows no indication of moisture the card shall be photographed. If moisture sensitive

components are received without proper dry packaging and fake MSL indicator the lot shall be rejected or the MSL reset per the applicable requirements. . A new traveler will accompany the components until they are shipped to the customer. All components shall be packed and sealed in a moisture bag to the proper MSL level before delivery to customer. Procedures for the handling, storing, re-baking, and shipping of moisture reflow sensitive devices shall be in accordance with the levels defined in J-STD-020 and J-STD-033.

#### **4.3.4 Military marked components**

The commercial inspections listed above plus the applicable standards listed below shall be used for determining authenticity of military specification components. Any samples that fail to meet these criteria shall classify the component population they represent as counterfeit and shall all be rejected. The QML, QPL, specifications and standards listed in Reference Documents shall be used for information to verify the authenticity of military parts.

##### **4.3.4.1 Integrated circuits**

Integrated circuits, which are ordered to military specifications, (QML, QPL, DSCC SMD and /883) shall be subjected to the inspections of paragraph 4.3.3, 4.3.3.1 herein and the External Visual Inspection per Test Method 2009 of MIL-STD-883. In addition, the components shall contain other specialized markings as defined by the specification controlling the components. Components ordered as a MIL STD 883 (883/C) require an OCM Certificate of Conformance to prove the testing was performed and provide assurance that they meet the requirements. MIL-STD-883 compliance testing and screening, can only be performed by the OCM. Components without the OCM C of C for Mil-STD-883 cannot be accepted.

*(Verification that the specified testing has been performed is virtually impossible after the fact. These are among the easiest components to counterfeit as only /883 and letter C has to be added to the commercial components markings to make them look authentic. This marking should match the other component markings.)*

##### **4.3.4.2 Transistors and diodes**

Discrete semiconductor devices, transistors and diodes shall be inspected for conformance to paragraph 4.3.3 – 4.3.3.1 herein and the external visual criteria of Test Methods, 2066, 2068 or 2071 of MIL STD 750 as applicable.

##### **4.3.4.3 Passive components**

Passive components shall be subjected to the visual, dimensional and marking requirements of the applicable military specification for authentic marking. The package and markings shall be examined under adequate magnification to detect signs of alteration or substitution. Passive components for both level A and B shall be electrically tested per 4.9.6.

#### **4.4 Ink marking**

##### **4.4.1 Marking permanence & blacktopping**

The permanence of component marking shall be performed on a minimum of three (3) samples selected from the visual inspection samples as specified herein.

##### **4.4.2 Standard marking permanency (MP)**

Three samples, one for each solvent solution, are required for this test. When these samples are selected in accordance with decap sample criteria, they may be used for the decap.

The marking permanency shall be performed according to JESD22-B107C Marking Permanency, using solutions A, B & C except a cotton swab may be used in lieu of the brush and the tape test is not required. This test is only for the markings and not a test for overcoating. This test is not required for positively identified laser marked components.

*(This test is to verify the OCM's marking permanency, but may not identify when the markings are counterfeit, as it may not remove cured epoxy paints or special clear overcoats used to protect the remarking.)*

##### **4.4.3 Acetone test**

This is a test for blacktopping and overcoatings with solvent-soluble blacktopping when applied to cover sanding marks and previous markings and performed on 3 samples. Mask-off part of the component markings to protect them and perform this test on half or a corner of the part that intersects a portion of the marking. This provides a sharp line of contrast between coated and uncoated areas for inspection and

photomicrography, and removes the possibility of confusing the solubility of markings with the solubility of the blacktopping. The acetone test for "blacktopping" should be done by rubbing vigorously the component surface with a cotton swab that has been saturated in acetone. When the acetone test removes a coating from package the population shall be rejected as suspect remarks. If the OCM will not verify they remarked the components, the lot shall be declared counterfeit.

#### **4.4.4 Blacktopping and overcoat detection**

##### **4.4.4.1 Sample selection**

Three samples shall be selected in the following order of preference:

- 1) Components appearing visually to been coated, blacktopped or other suspicious conditions.
- 2) In the absence of components appearing to been altered, samples shall be randomly selected from through out the population.

##### **4.4.4.2 Detection Procedure – Scrape and Solvents**

The acetone test may not reveal a coating applied after sanding to restore surface smoothness and conceal striations. This coating may also be of the thermal or UV-cured epoxy type, which is not soluble in acetone. The PEMs components, which pass acetone test shall be tested by scraping the component surface with a new, sharp blade to detect if a coating has been applied to the body of component to inhibit the acetone test. The scraping shall be vigorous and with pressure to assure access to the body when coated. Any peeling or flaking of the material indicates coatings not soluble in acetone have been applied when the acetone test does not reveal remarking the samples shall be tested in series with these solvents heated per the manufacturers' directions in following order:

1. n-methyl-pyrrolidone (NMP)
2. Dynasolve 2000 or equivalent

Half of the top, showing the date code, shall be protected with Kapton tape from the solvent liquid/fumes. The unprotected half shall be inserted in solvent in vertical position using a metal holder such that the heated solvent reaches to the tape. The solvent shall be preheated in a beaker using a hot plate under a vented hood and the part inserted for adequate time to dissolve the coating. The part shall be removed from solvent and vigorously scrubbed with alcohol. Remove the protective tape and inspect the surface for signs of overcoating, old markings, sanding marks and remarking. Any component whose markings are removed or disturbed by these tests shall result in rejection of the complete population that the sample represents unless there is positive proof the OCM remarked the components. Photographs shall be made before and after the test, without the tape, to clearly show the results. These tests are destructive and the part shall not be delivered to the customer as part of the order quantity.

*It is recommended that this test be performed by a laboratory that has the proper safety equipment and procedures.*

##### **4.4.4.3 Plastic ball grid and pin grid arrays (PBGA)**

Coatings are being used that can withstand acetone and many of the traditional strippers. PBGAs shall be tested as described above.

#### **4.5 Laser Markings**

Laser markings shall be smooth and consistent and show no signs of burned package or holes and match the OCMs typical markings. Counterfeiters have become very proficient in remarking parts with laser. The previous markings have to be removed or covered before laser marking can be applied. This is the reason extensive effort must be made to determine if the components have a coating applied. Attempts must be made to determine if the OCM was using laser markings for the date code shown on the part. Extra investigation must be performed to detect previous markings removed by sanding, micro-abrasion, etching or other techniques.

#### **4.6 X-ray inspection**

X-ray inspection shall be performed on all of the visual inspection samples, prior to selecting samples for decapping to determine that the package contains a die, the die size, consistent internal construction and if the die has wire bonds. X-ray inspection and imaging should be used to determine the exact die location within the package, so as to avoid cutting of internal wires when decapping the component. Any components

exhibiting construction differences detected by x-ray shall be decapped to identify that the die are all exactly alike.

*The value of X-ray is increased when there is a known good OCM device available for comparison of internal details.*

#### **4.7 XRF and solderability testing**

XRF testing shall be performed before solderability testing. Any lead failing solderability requires customer approval for acceptance. In addition, one lead from each component shall have base metal and plating tested for conformance to the materials identified by the component markings.

The semiconductor samples used for decapsulation shall have a minimum of two leads from each sample tested for solderability in accordance with J-STD-002 or MIL-STD-883, TM 2003 as applicable or as specified by customer. The balls and pins shall be XRF tested for correct plating content. BGAs and Pin Grid array packages are excluded from solderability as no standard procedures for this test are available.

*Note: It may be necessary to verify if a legitimate change in lead plating material was made by the OCM.*

##### **4.7.1 XRF testing**

Two leads from each of the components used for decap shall be analyzed to ensure that the lead finish/plating elements match the OCM specifications. Two balls minimum from one BGA shall be tested for correct materials. The results shall verify that the component leads contain the correct metals. Failure of one or more of the components shall result in the lot being rejected.

##### **4.7.2 Solderability (Excludes BGAs, PGAs and surface mount passives)**

Leads on two decap samples shall be tested per JEDEC-STD 22-B102E, method 1 or 2, as applicable. Test samples shall exhibit a continuous solder coating free from defects for a minimum of 95% of the critical area of the individual lead. The exposed leads/terminal surfaces shall exhibit a continuous solder coating free from defects for a minimum of 80% of the critical area of those surfaces. Defects include:

- gaps
- voids
- de-wetting
- contaminants
- dross
- pinholes

Anomalies other than de-wetting, non-wetting and pin holes are not cause for rejection. Rejection of one of the samples shall result in the lot being rejected. The tested leads shall be photographed after solderability test to capture the results, pass or fail.

#### **4.8 Decap and analysis**

Decapping shall be performed on a minimum of three (3) suspect samples, if none are suspect, randomly selected semiconductor components from X-ray for each lot/sub-lot as defined in Paragraph 4.3.1. When the order is for 20 components or fewer, only two samples are required to be decapped. Chemical decapping shall not be performed by immersing the entire PEM package in acid but through selective etching.

*Note: Decapping of semiconductor devices is performed to allow high magnification photomicrographs for inspection of the internal die for authenticity to the OCM named on the external package. The entire die, along with its markings and manufacturer's logo shall be photographed as described in 4.2.4*

##### **4.8.1 Integrated circuits and discrete semiconductors**

The ID shall have personnel specially trained and equipment to perform decap or utilize a competent contract lab for this operation.

Hermetically sealed components should be decapped by mechanical method of cutting or shearing open package. Decapping of plastic encapsulated semiconductors shall be performed by chemical techniques. Precaution must be taken to prevent damage of the die or interconnection wires. Decap samples shall be examined for:

- A. The correct OCM name or logo is marked on the die. (Note: additional research may be required to assure it is the correct die for the part number marked. Some die may not contain any markings. Numbers on legitimate OCM IC die may not be the same as the part number)
- B. Logos on legitimate OCM die may not be those of the manufacturer marked on the package, due to cross-licensing and patent expiration. Without proof of these facts by the OCM, the components must

- be rejected as counterfeit. There may be a significant time difference between the date on the package and the date on the die, as the same die mark could have been used for many years.
- C. Ink dots on the die that indicate, it was rejected by the OCM.
  - D. Condition of the bonding wires may indicate that the part is reject
  - E. Determination that the markings on the die match the OCM markings for the component type marked on the package.
  - F. Indication of electrical overstress such as fused metal, ruptured oxide, excessive heat, etc.
  - G. Indications of corrosion due to moisture or other contaminants entering the package.
  - H. Photo records shall be made with enough detail to clearly reveal the characteristics being inspected by use of: 1) digital photomicrographs of the die including the wire bonds to chip pads and package leads; 2) Higher magnification photos that clearly show any markings and name or logo on the die.

#### **4.8.2 Decapsulation results**

The semiconductor or decap samples shall be photographed and observations recorded in the inspection report. Observation of any characteristics or condition that is not authentic to the named OCM or indicates the component was previously used shall result in rejection of the total population the sample represents. Use of an authentic device (Gold Standard) for comparison is a useful technique. Special procedures may be required for unusual packages and glass diodes are excluded from decap.

*Some OCMs may provide assistance to determine whether the die is authentic*

#### **4.8.3 Passive components**

- A. Passive components samples are not required to be decapped. Their physical characteristics vary considerably by the type of component. Various methods are required to verify authenticity and use of a competent outside lab is recommended. Check markings, if any, measure and record physical dimensions and packaging is by OCM.
- B. X-ray of electrolytic capacitors to check internal elements and compare to known authentic.
- C. Electrical test all capacitors, resistors, relays and magnetics for parameters as specified in 4.9.6.
- D. Check for workmanship issues.
- E. Authentic samples can usually be purchased from OCMs and ADs.
- F. Some OCMs may provide assistance to authenticate the components.

#### **4.9 Electrical testing, required for Level A verification (diodes, transistors and integrated circuits)**

Electrical testing is a key procedure in determining that components are authentic to an OCM's data sheet or military specification. The electrical testing of samples is to determine they conform to the identified marking. Some basic electrical testing may be performed by the ID on certain component types using handheld or bench top testers but these do not satisfy the Level A Requirements herein. This testing can determine whether the components internal bond wires are connected or shorted before performing more expensive testing. The testing of more complex components will have to be performed by an experienced test house with suitable equipment. The ID and test lab must agree on the specific tests to authenticate the component to the data sheet. These tests shall be identified/marked on the OCM data sheet or military detail specification by the test contractor. The ID shall require all test labs utilized to certify with A-7 form that they understand and will conform to the tests requirements described herein.

##### **4.9.1 Electrical test samples for semiconductors**

For lot sizes of 30 components or less, all (100%) of the devices shall be tested as defined herein. For homogenous lots larger than 30 components, the ID shall randomly select 30 test samples per 1000 pieces from each lot/sub-lot. A catastrophic failure (open, short, other) in one or more of the test samples shall be cause to reject the entire population. In the case of failure of one or more samples for minor parameter limits, the whole lot can be 100% tested to identify and salvage the compliant components. This only applies when none of the previous inspections and tests indicate components are suspect counterfeit. The specified tests shall be performed to the OCM's data sheet for commercial devices and the Military detail specification for military part numbers. The customer may specify larger quantities to be tested. The electrical test samples shall be maintained separately from the remainder of the lot.

##### **4.9.2 Parametric**



Parametric testing, pin opens and shorts, DC and AC can determine whether the device is grossly defective or not authentic to the component ordered. Comparative bench testers can test basic electric parameters if a known-good-authentic device for the type under test is available. All measurements shall be read and recorded in database and returned with the components.

*(Note: Improper parametric testing can damage otherwise good and authentic devices. When a curve tracer is used, the operator shall be fully trained on the equipment and semiconductor device operation. An engineer or senior technician is recommended.)*

#### **4.9.3 Functional testing**

Functional testing is not required for CCAP-101 Level A components. However, the customer may specify such testing when required for their applications. This testing can be difficult to perform but valuable in component authentication to the OCM component data sheet.

*It is typically expensive and in many cases OCM functional test software is not available.*

#### **4.9.4 Integrated circuits**

Integrated circuits when specified as Level A shall be electrically tested as specified herein and to the extent necessary to assure authenticity of the test samples to the markings. Specific parameters to be tested shall be agreed by the Approved Test Lab and approved by the ID. These tests shall conform to the OCM applicable data sheet or military specification. Examples of minimum parametrics to be tested are listed below:

- A. Digital logic:
  - Continuity & shorts
  - DC parameters, 25 °C and min/max temperature
  - Other tests to verify authenticity
  
- B. Linear, Op Amps & Mixed logic
  - Continuity & shorts
  - Full power & voltage conditions
  - DC parameters, 25 °C and min/max temp
  - AC parameters 25 °C
  
- C. Microprocessors, DSPs, Microcomputers & similar
  - Key DC parameters at 25 °C and min/max temperatures
  - Supply leakage current
  
- D. Memories, RAM, FPGA, etc.
  - Input and output pins, open and short
  - DC parameters at min/max temperature
  - FPGAs are unprogrammed (required on 3 samples)
  - Write and read to memory and speed, for RAM and FPGA
  - Other applicable tests
  
- E. Other Type Devices
  - Similar parameter verification

#### **4.9.5 Discrete semiconductors**

Discrete semiconductors specified as Level A shall be tested to the OCM data sheet or military specification as applicable to the component to verify authenticity. The following minimum tests are guidelines for electrical testing.

- A. Transistors
  - DC & AC (gain) at 25 °C and max temp. at medium and min/max current
  - Leakage currents,  $I_{EBO}$ ,  $I_{CBO}$ , at rated voltage
  - Vce (sat) at rated current
  
- B. Diodes

$V_F$  Forward voltage drop at rated current  
 $I_R$  Reverse leakage current at rated voltage

C. Zeners

$V_Z$  Knee voltage  
 $I_R$  Leakage current

D. SCRs, thyristors

Holdoff voltage  
Peak trigger current  
Leakage current

E. Other Discretes

Per data sheet or mil specification

#### 4.9.6 Passive components

All unmarked passive components (both Level A & B) or not contained in OCM original and verified packaging shall be sample tested, 30 pcs/1000 components for parameters specified below.

The tests shall be in accordance with OCM data sheets or military specifications as applicable.

A. Capacitors:

Capacitance and tolerance at 25 °C and min/max temp  
DWV  
Dissipation factor as applicable  
ESR (Electrolytics only)

B. Inductors:

Inductance over or within specified frequency and temperature range  
Q  
Series resistance

C. Resistors:

Resistance and tolerance at 25 °C and min/max temp.  
Temperature coefficient

D. Other Passives

Applicable parameters

#### 4.9.7 Electrical Test Data recording

The organization performing the electrical testing shall record the parameter conditions and limits used for acceptance of the components. The data from these tests will be recorded for all parameters that have a minimum or maximum limit on the datasheet. This data shall be included with the CCAP-101 inspection report to customers.

#### 4.10 Use of contract test labs

When the ID elects to use outside test labs for x-ray, decapsulation, die authentication, solderability, XRF for lead material verification or electrical testing, the ID is fully responsible for the results and actions taken. In addition to the test labs certifying the testing to the A7 form of this document, the ID shall employ valuation criteria and ratings to select only competent test labs with equipment suitable and personnel trained for the test and inspections they will perform. The requirements specified herein for these tests and inspections shall be imposed on the test house. The contractor shall not change, alter or modify the test requirements. The test house shall return specific data (photos, narrative description of the findings), read and record electrical test data that verifies the status of the components. To obtain ID approval, test labs shall complete Appendix A7, Certification for Test Labs.

CTI reserves the right to audit each test house to verify their training, equipment and procedures suitable for the contracted work. When the tested components and data are returned, the ID shall thoroughly inspect the

photos and test results to assure conformance to the requirements. *ID should keep the number of Approved Test Houses used to no more than three (3) for each type of testing required.*

#### **4.11 Additional testing and services**

The ID shall identify the value added testing and analysis and ensure that the operations are carried out under controlled conditions, including the following:

- A. Documented work instructions defining the operations, handling, package container opening, ESD practices, name of the approved lab that was utilized, etc.
- B. For packaged products the marking process shall not alter or obliterate the OCM's marking or component body;
- C. Customer specified component programming and electrical tests shall be documented in procedures covering the master units and shall include program revisions/changes as required.
- D. Components which have had extra testing, screening or programming performed on them in accordance with a specific customer order shall not be restocked with, or sold as, OCM authentic product.
- E. Value-added processing (e.g., environmental screening tests) performed by the ID's subcontractors shall conform to the same quality system requirements contained herein.

The customer may specify additional tests and services to be performed by the ID after the component's authenticity has been established. The types of additional tests and services may include:

- A. Reballing BGAs (This will nullify future acceptance to CCAP-101)
- B. Additional electrical tests
- C. Programming
- D. Tape and reel or other packaging
- E. Other value added tests

#### **4.12 Documentation and inspection records**

The ID shall record all inspection results on A1 through A4 forms as appropriate for the samples from each lot or sub-lot that is inspected, pass or fail. The records shall contain the following information:

1. OCM's name marked on the part
2. Date code and lot number, if marked
3. Name of country marked
4. Marking permanency results
5. All observations made and inspection results, including photos, shall be used to assure markings match the OCM practices, fonts, physical dimensions, correct number of leads, condition of leads, other areas of concern, internal observations from decapping and to detect any sanding or blacktopping,
6. Digital photos of components characteristics and marking from 3 samples per lot/sub-lot.
7. X ray results and copy of units
8. Decap findings and photos of all markings on the die and metal pattern
9. Electrical test results, as specified herein plus read and record data.
10. Status of component inspection results: accepted \_\_\_rejected\_\_\_(For the file process no further)
11. Names of persons performing the inspections and date
12. Supplier of components to ID not required to customer
13. Customer that ordered the components and purchase order number
14. Certificate of Compliance – Appendix A-5

##### **4.12.1 Final approval**

All inspection and test results performed by the ID or contract lab shall be reviewed and approved by an experienced and trained management personnel on the A-1 form. The approving person must not have performed any of the tests and inspections.

##### **4.12.2 Submission to customer**

A printed or electronic copy of the CCAP-101 inspections results as selected by the customer, including digital photos and Certificate of Compliance for the order shall be supplied to the customer with the shipment. Identification of the supplier to the ID is not required in the data package.

#### **4.12.3 Retention & Retrieveability**

A complete copy of the report and data package shall be maintained by the ID for a minimum of five (5) years for both commercial and military components. The data shall be retrievable by P/N, OCM, date code, supplier, counterfeit characteristic and include photos of the characteristics.

#### **4.12.3 Annual review by certifying organization (CTI Inc.)**

A summary report of all lots processed (rejected and accepted) for CCAP-101 Certified Components shall be available for review by CTI Inc. within 30 days of the anniversary date of the ID's Certification. This report shall be prepared for both authentic components accepted and components rejected and include photo of shipping label showing supplier's name and supplier's tracking info. All photos shall be supplied in JPEG format.

#### **4.13 Appendices**

The Appendices for this document provide details to be included in the IDs Certification Procedures and Inspection of components to detect counterfeits.

*The Appendices are only provided to an ID when their CCAP-101 implementation procedure is submitted for approval.*

### **5.0 Responsibilities**

#### **5.1 Independent Distributors (IDs)**

Electronic component Independent Distributions certified in accordance with this document are fully and completely responsible for all components supplied to CCAP-101 and to implement the requirements of the Counterfeit Components Avoidance Program as defined herein and in accordance with their procedures approved by CTI Inc. The ID is fully responsible for any financial litigation between their organization and the customer for components delivered or associated damages.

#### **5.2 Certification request**

An ID desiring to become a Certified to CCAP-101 supplier shall complete and submit an application to Components Technology Institute, Inc. The Application for Certification can be found on web: <http://www.cti-us.com/CCAP.htm>

#### **5.3 Certifying organization**

Components Technology Institute, Inc. has full ownership rights to the CCAP-101 Certified Program which are Copyright and Trademark protected. CTI is the only organization that has the authority to provide training on the implementation of this Program, to approve ID Counterfeit Avoidance Practices, to investigate and resolve counterfeit issues, to grant Certification to IDs, to de-certify IDs, when they violate requirements of CCAP 101, and to make changes to the Program.

##### **5.3.1 Certified Independent Distributors**

CTI will maintain on their web site [www.cti-us.com](http://www.cti-us.com) a list of IDs that have been certified to CCAP-101. The Certified ID list will be promoted to OEMs that manufacture electronic equipment. IDs may link their web site to the CTI list of Certified IDs.

##### **5.3.2 Delivery of Counterfeits**

The ID shall report to CTI by e-mail within 3 working days of being notified by customer that counterfeit components or counterfeit suspects were delivered to them and provide data requested by CTI. Supply of components to CCAP-101 Certified shall be discontinued until re-approval is granted by CTI.

##### **5.3.3 Impact of Counterfeit Components**

If Certified counterfeit components are delivered to a customer, the ID Certification will be suspended by CTI until the contributing cause and corrective action is resolved to satisfaction of CTI. Delivery of counterfeit components or unresolved issues may result in termination of the ID's Certification.

##### **5.3.4 Contact information:**

Components Technology Institute, Inc.  
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## Appendices

Appendices A-1 thru A7 are available from CTI to for use by certified IDs,

- A-1 Summary of Inspection Results
- A-2 Incoming Inspection Results
- A-3 X-Ray, XRF, Decap and Solderability Results
- A-4 Electrical Test Results
- A-5 CCAP-101 Certification of Components by ID
- A-6 Examples of counterfeit components (available by request to Certified IDs)
- A-7 ID Approval of Test Labs for CCAP-101 Testing & Inspection