

# Ceramic Chip Capacitors

## **Application Overview:**

Historically, inspection of monolithic, ceramic chip capacitors was one of the first uses of scanning acoustic microscopes. The more common use of SAMs are in space-bound or high reliability capacitors. Ensuring capacitor material integrity is integral in ensuring long-term functionality. A variety of military standards require acoustic inspection of some or all capacitors being used. Almost every capacitor manufacturer in the world uses SAM equipment in a failure analysis or process control role. Inspection can be performed on board mounted, loose or over-molded capacitors. Semi or fully automated inspection is possible with throughput in the 1000s.

## **Package Types:**

Ceramic monolithic multi-layered chip capacitors  
Discoidal ceramic capacitors  
0805 sized capacitors or larger

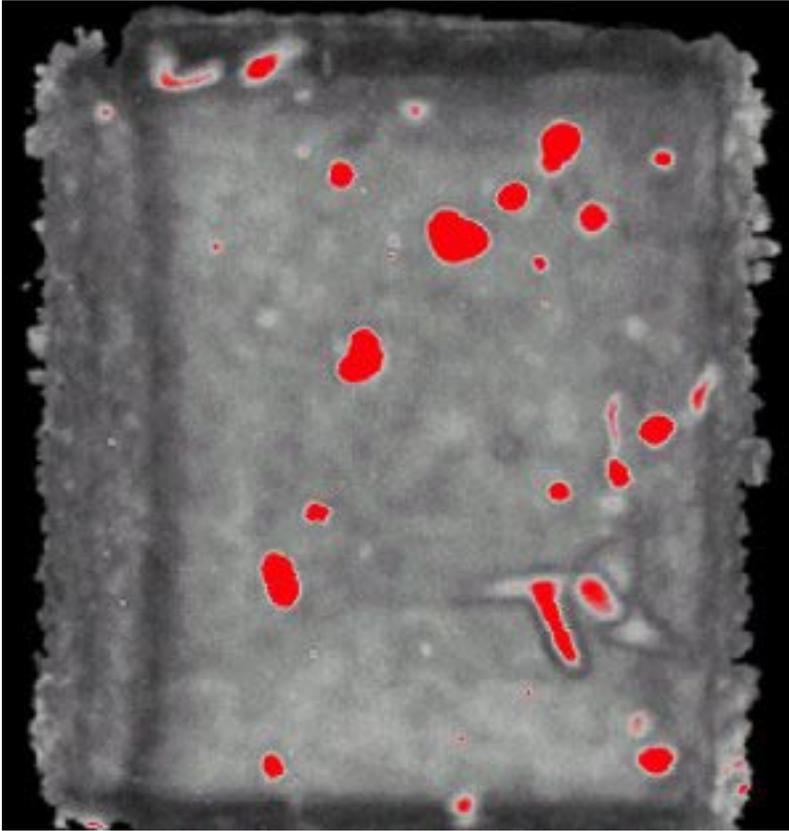
## **Inspection Standards or Certifications:**

MIL-C-123, EIA RS-469

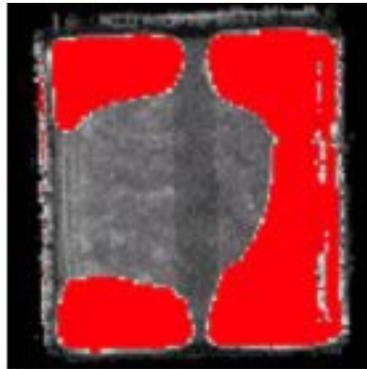
## **Failure Types Commonly Detected:**

Delaminations  
Micro-delaminations  
Termination delaminations  
Knit-line delaminations  
Voids  
Elongated voids  
Cracks  
Chip outs  
Micro-porosity

## Images:



This is a pulse-echo mode image using a 75MHz 12mm focal length. This peak amplitude image utilizes a material scan technique to display information regarding the integrity of the entire capacitor. A color palette adjustment was made so defects appear as red in the image. Delaminations within the dielectric layers appear as large red areas. A elongated void which is likely caused by the baking out of a fibrous or dust particle contaminate can be seen as a curved red object. Voids or any other type of air gap that crosses several dielectric layers can cause an electrical short within the part. Typically acoustic inspection is performed to determine long term capacitor reliability by culling devices with delaminations, large voids, cracks and so forth.



These are pulse-echo (reflected) mode C-scan images using a material scan imaging technique. A 75MHz 12mm focal length transducer was used to create both image. Same as before, the material scan displays information regarding the integrity of the entire capacitor. Both images are of the same capacitor pre and post-stressing. The image on the left was taken at time 0. The image on the right shows significant delamination after 50 hours of electrical and temperature stressing. The dark band down the middle of the capacitor is the result of an area were the alternating dielectric layers within the capacitor overlap. A separation of dielectric layers within the capacitor can seriously impact the electrical reliability of the unit.