

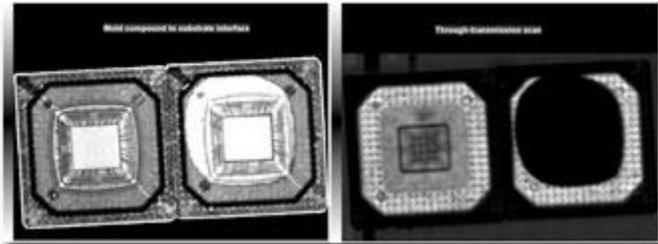
The Difference A Color Map Makes

Center image shows the actual internal condition of a PEM. Delamination is visible at the die paddle and some leadframe elements. The images at left and right show the same part with two different color maps applied. At left, the part has been made to look completely good. At right, the part has been made to look much worse than it really is. An understanding of the color map used and, preferably, of the echo waveforms at various locations, is necessary to accurate image interpretation.



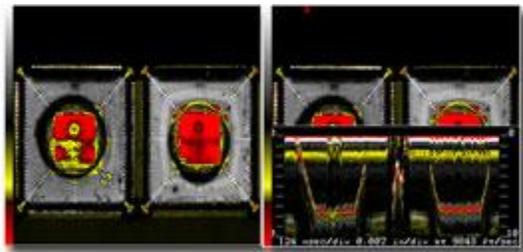
BGA Delamination

Moisture-induced delamination in a plastic-encapsulated BGA package. Image at left shows the mold compound to substrate interface. The bright white area represents delamination at this interface. Image at right is a through-transmission image of the same two devices. Delaminated region appears black in this image.



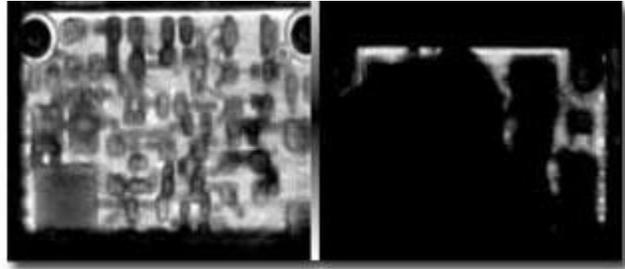
Popcorn Cracking

“Popcorn cracking” in a plastic quad flat pack (PQFP). In the image at left, delamination of the mold compound from the paddle is shown by the red areas at center. The black region surrounding the paddle is a “shadow” cast by the package crack. The image at right shows a virtual cross-section of the package cracks, which can be seen extending upward from the paddle at a steep angle.



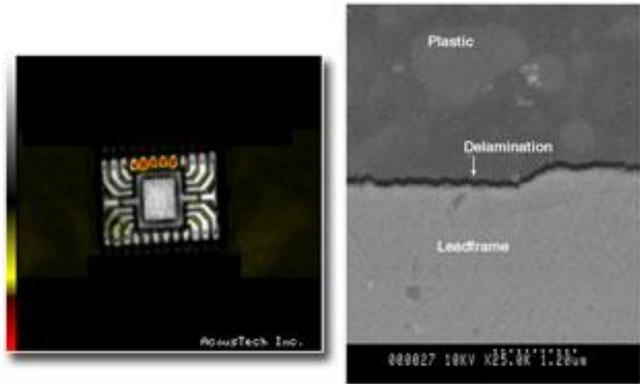
Delamination in Rigid/Flex Board

Through-transmission image of multilayer rigid/flex boards following attachment of components. A good board is on the left and a bad one on the right, where the large black area is delamination at the rigid/flex interface.



Leadframe Delamination in PEM

Acoustic image of plastic SOIC showing delamination of mold compound from leadframe (red areas in image at left). SEM image at right shows cross-section of the delamination. *SEM image courtesy of Hi-Rel Laboratories.*



Die Surface Delamination in PEM

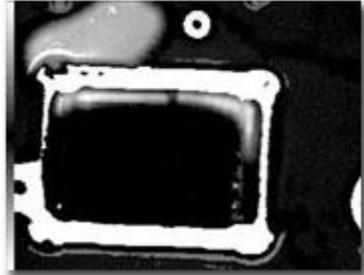
Acoustic image of a PQFP showing delamination over a portion of the die surface and die paddle.





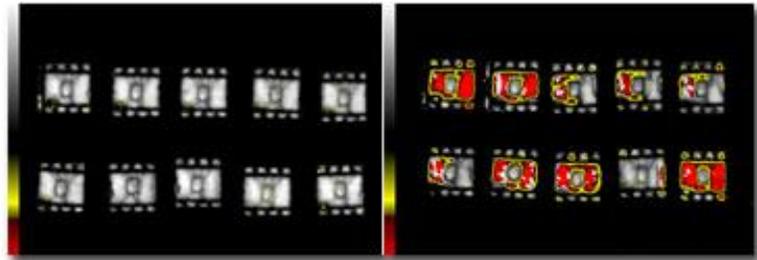
Ceramic Chip Capacitor Delamination

Acoustic image of a ceramic chip capacitor mounted to a printed circuit board. Delamination along electrodes is visible at the top edge of the component.



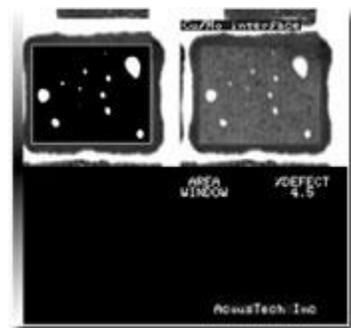
Moisture Sensitivity Level Testing

Moisture Sensitivity Level (MSL) testing of SOIC-8 devices. Images show pre-test (on left) and post-test (on right) condition of these parts. The delamination resulting from the test would cause the parts to fail the tested MSL level per J-STD-020.



Substrate and Header

Acoustic image showing bond between a substrate and header. Voids appear white. Digital Image Analysis provides a quantitative measure of the amount of voiding, 4.5% in this case.



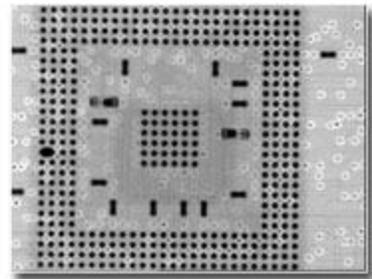
Potentiometer X-Ray

X-ray images of a potentiometer showing a bent contact.



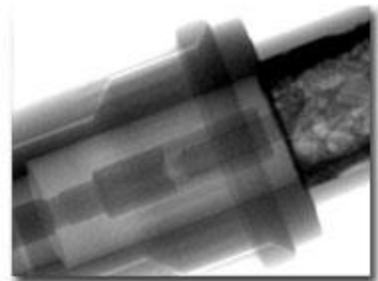
Solder Bridging in a BGA

Real-time x-ray image of a BGA device mounted to a printed circuit board. Excess solder is visible along the left edge, bridging adjacent solder balls.



Coax Connector X-Ray

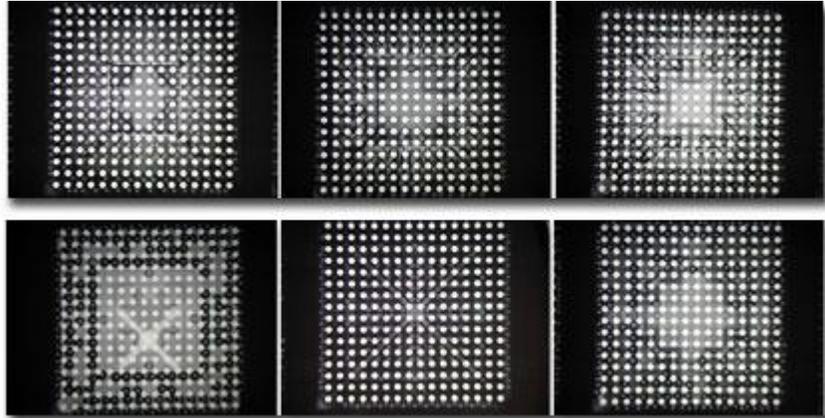
Real-time x-ray image of a coaxial cable connector.





Counterfeit Component X-Ray

All of these plastic-encapsulated BGA devices were reported to be from a single production lot. Note that each contains a different substrate pattern. In #2 and #3, the bondwires are severely damaged. In #4, #5 and #6, no bondwires are present.



Multilayer Ceramic Substrate

Subsurface crack in a multilayer ceramic substrate. The crack was not visible optically at low magnification (6X - 40X).



Metal Lever

This is a metal lever, about 6" long. Red circular area at upper right is a cluster of porosity, which led to early failure in similar levers.

