

Non-destructive testing of a memory module from GPSMAP 696, case ERA18FA030

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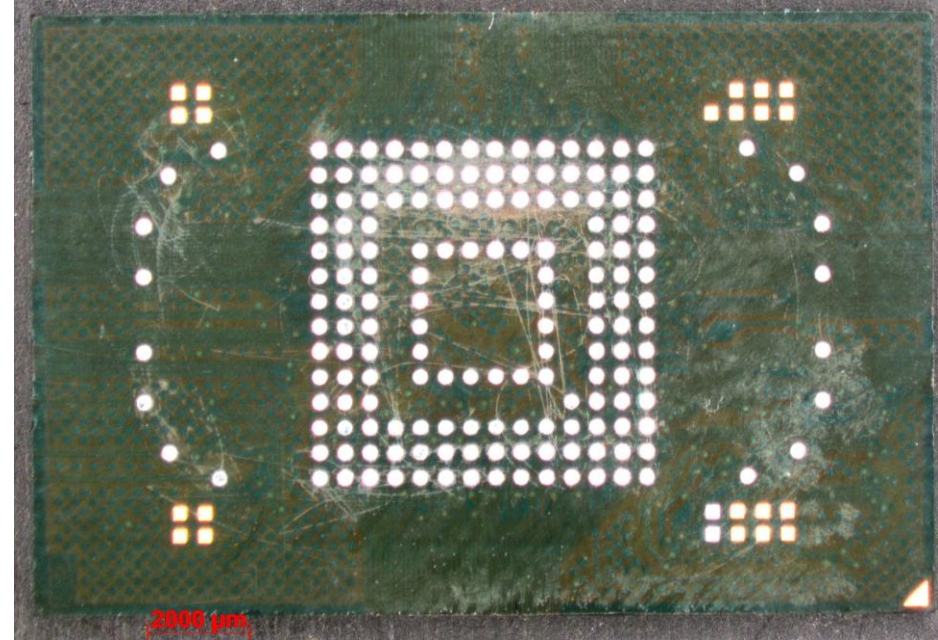
Summary and Conclusions

- One memory module, GPSMAP 696, ERA18FA030, was received for non-destructive testing to evaluate any physical damage to the package.
- The module was examined under the optical microscope, x-ray and the C-SAM equipment.
- A detailed optical inspection was performed. No external damage was detected in the module.
- X-ray imaging was done with the use of the medium size x-ray spot (mode 1) and Cu filter to prevent any data damage from the x-ray exposure.
- X-ray inspection results showed that the module has two dies: one large die and one small, thin rectangular die stacked on top of the large die. Both dies are wire-bonded.
- All wire bonds were examined at high magnification and from various oblique angles. No wire and wire bond damage was noticed.
- X-ray imaging was followed by the acoustic imaging. 100MHz transducer was used to acquire C-SAM images.
- C-SAM inspection results show that the large die has cracks possibly at multiple locations passing through its center. Delaminations were detected possibly due to mold lift-off near the crack locations. No cracks were detected in the laminated substrate.
- Since the die is cracked, it is not possible to retrieve any data out of this module.

Optical images



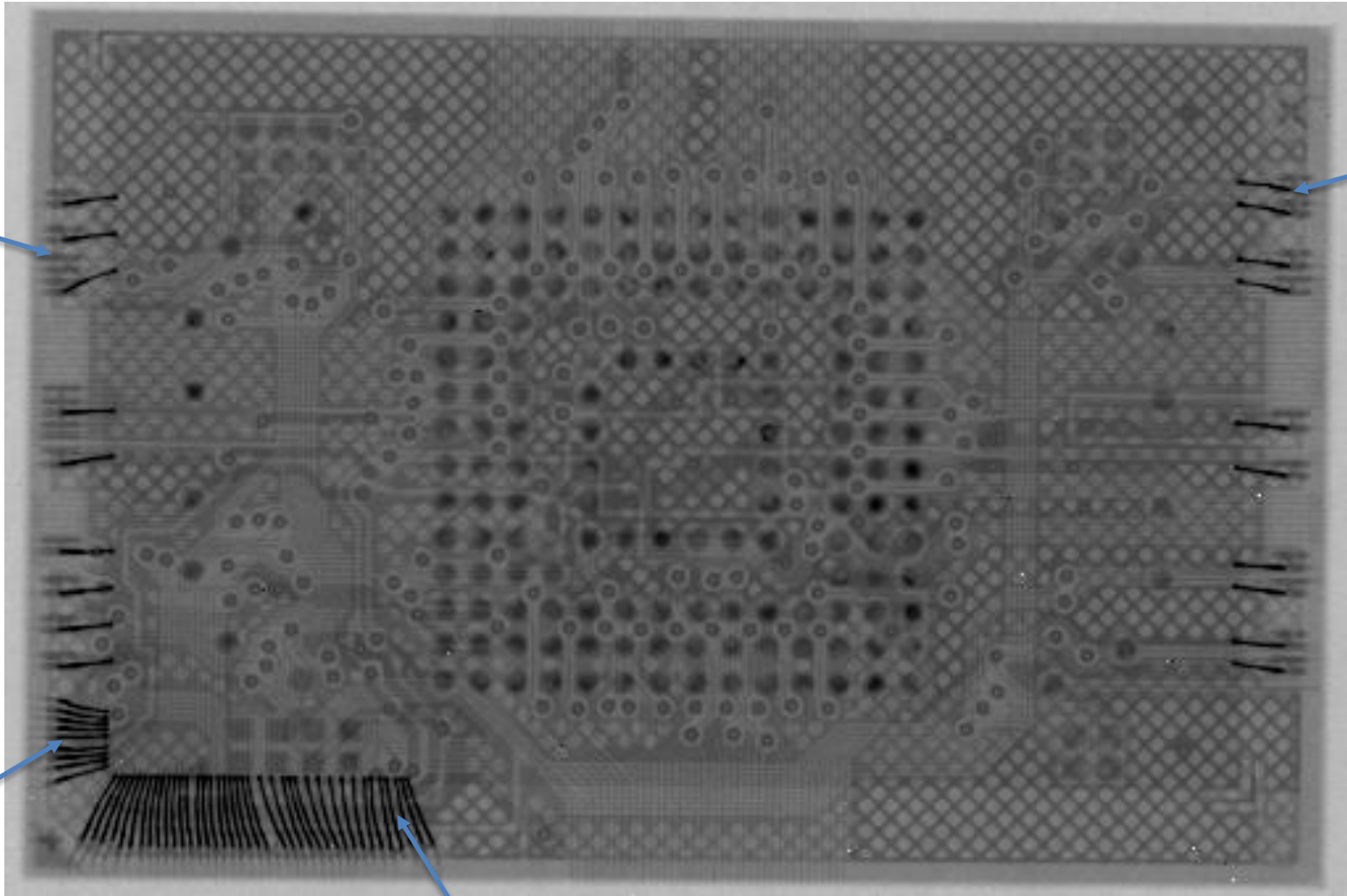
Front, mold side of the memory module



Back, laminated substrate side of the memory module

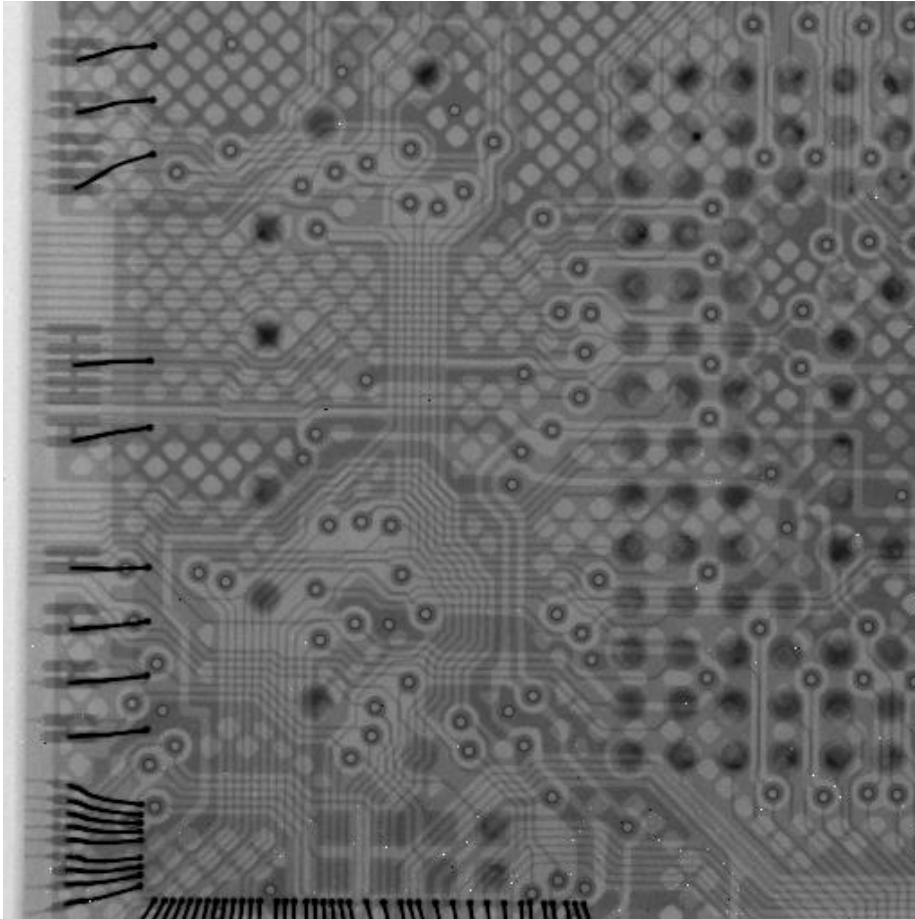
- A thorough visual inspection was done on the package from the mold as well as the laminated substrate side.
- No external damage was seen on any side.

X-ray image

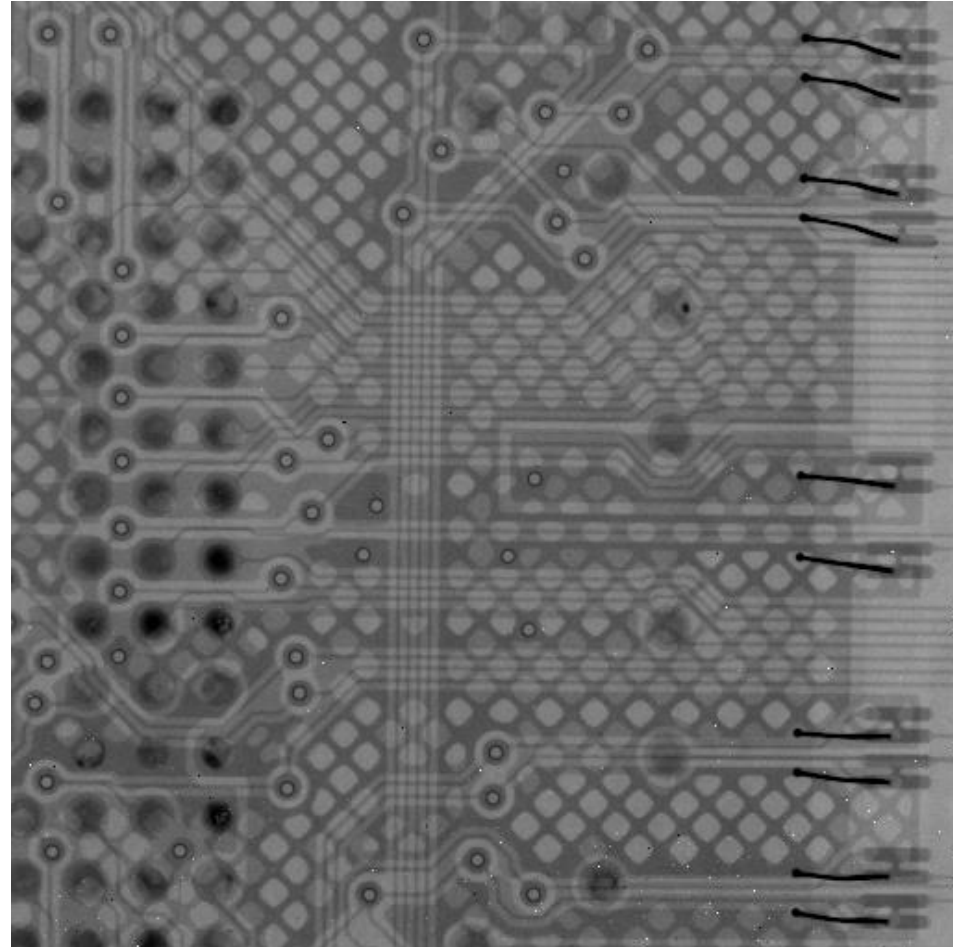


X-ray image of the entire package.
The package has wire bonded dies.

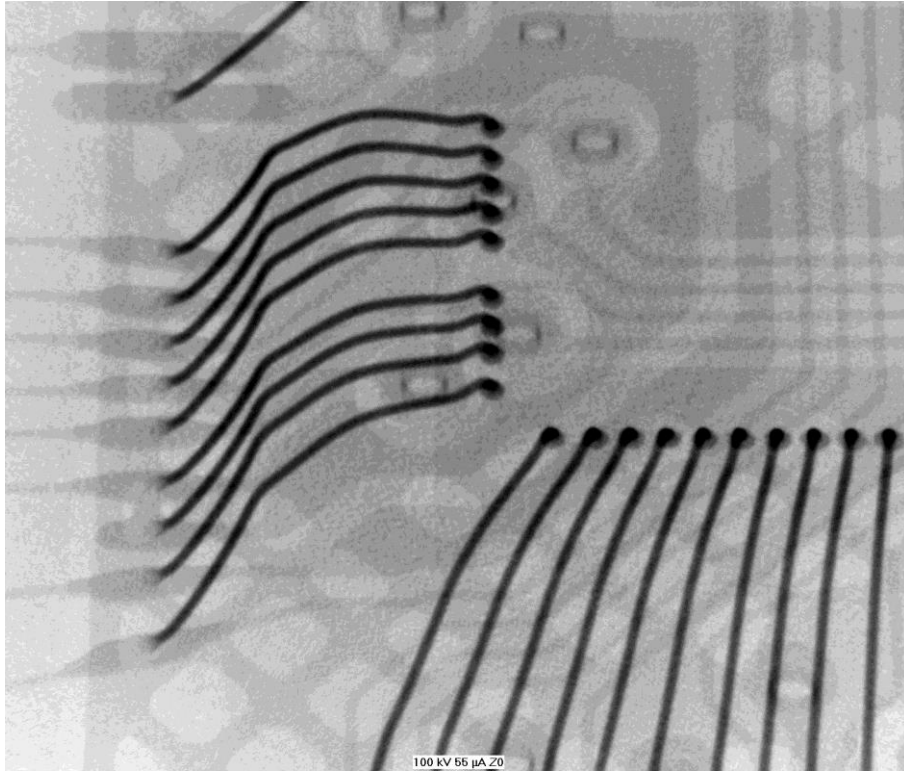
X-ray images



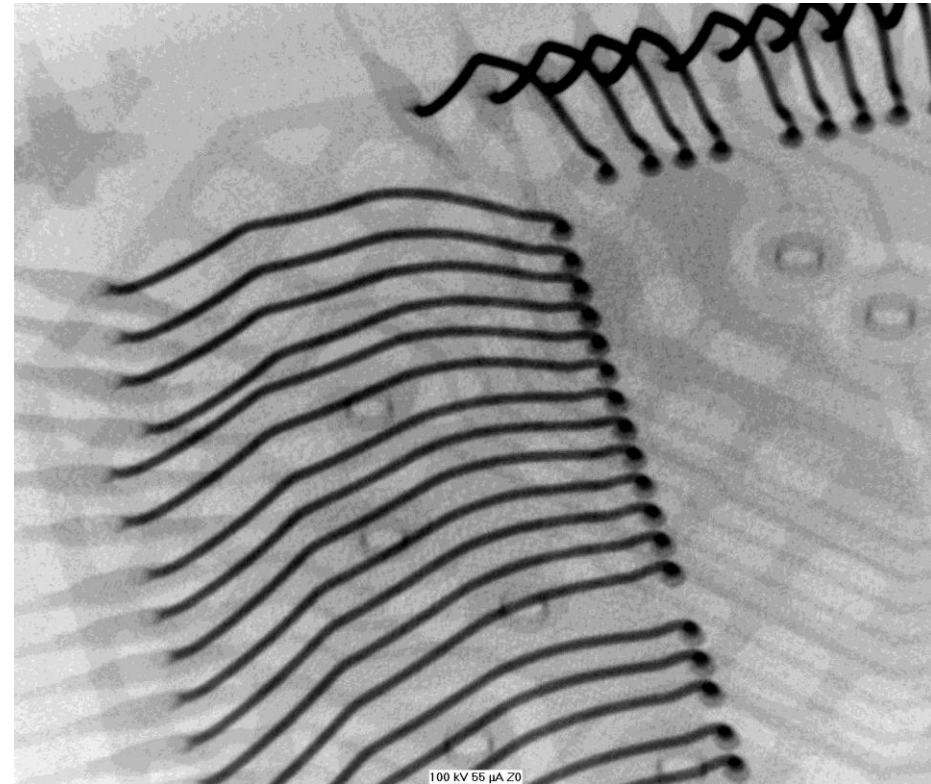
No wire bond damage is detected.



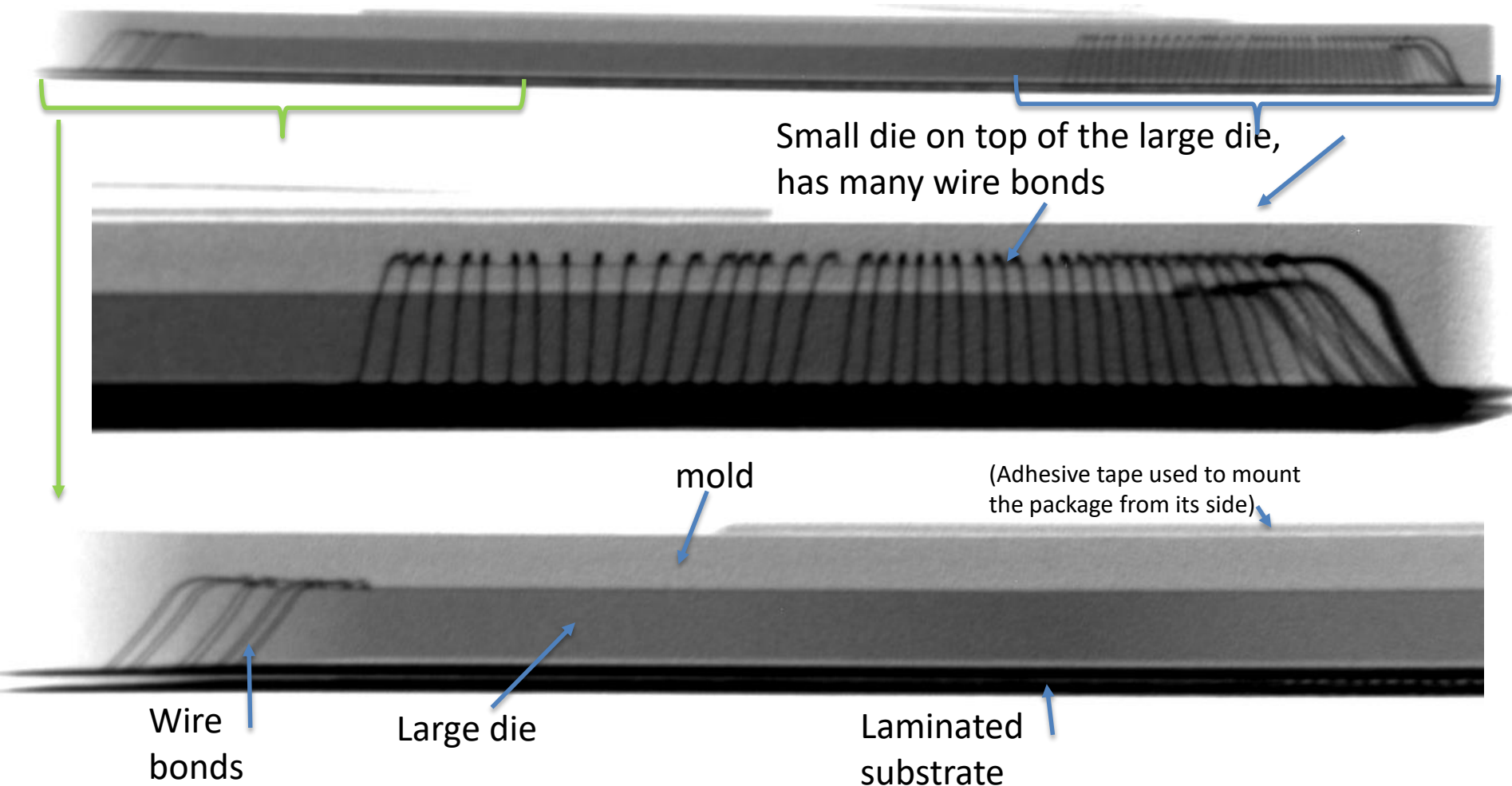
X-ray images



No wire bond damage is detected.

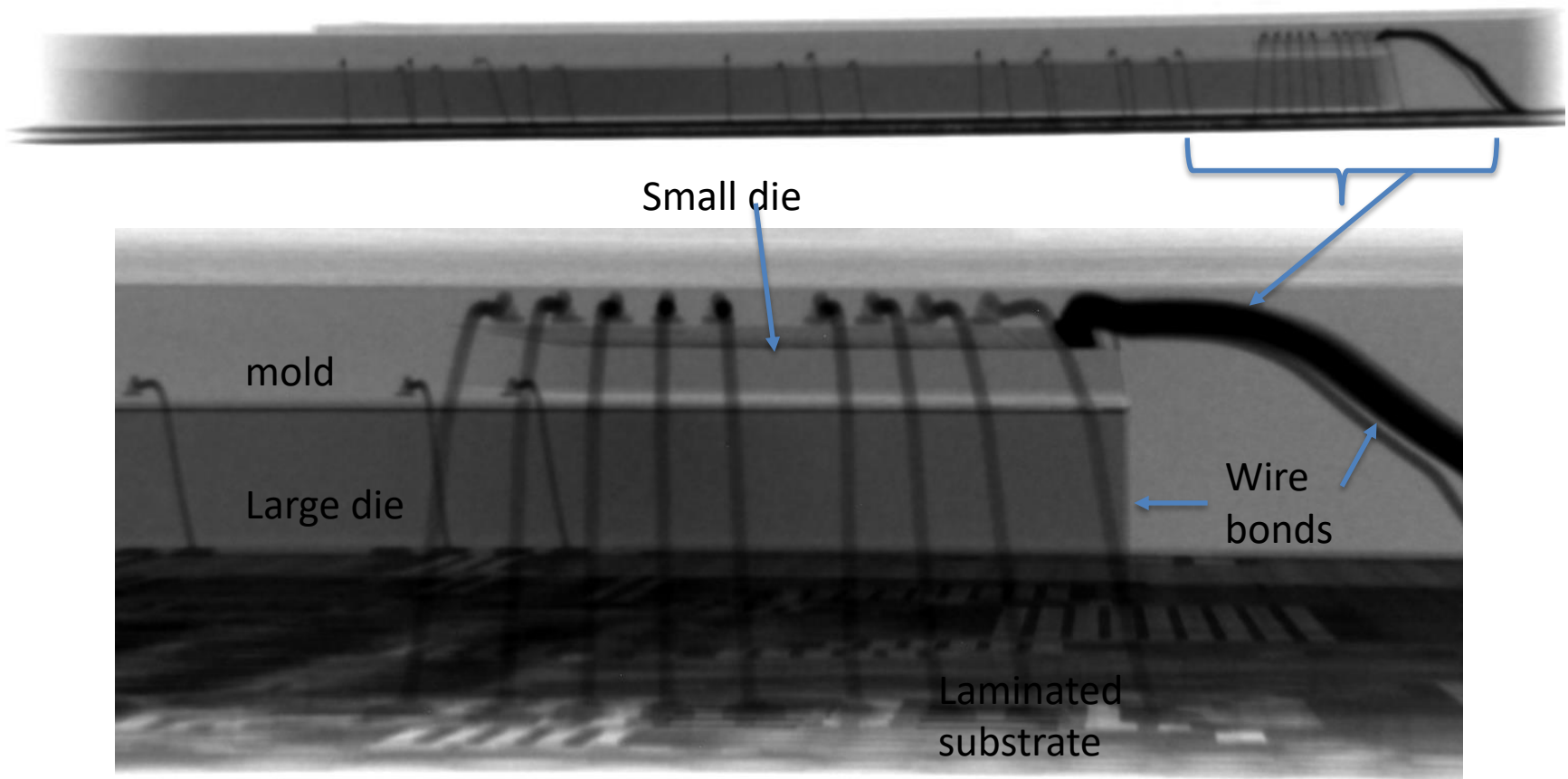


X-ray images of the package side 1



Side view of the memory module shows that it has a die covering large area of the package. A small thin die is stacked on its top. Both dies are wire bonded to the laminated substrate.

X-ray images of the package side 2



Side view of the memory module shows that it has a large die and a small, thin rectangular die on its top. Both dies are wire bonded to the laminated substrate.

Acoustic images



C-SAM image of the top surface of the package

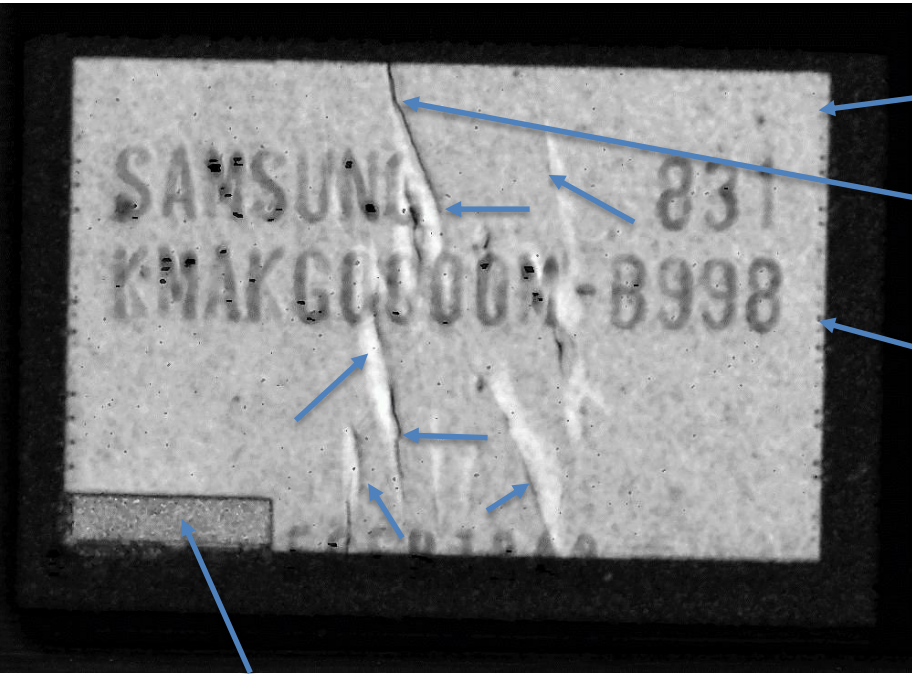
No damage is seen on the package surface and within the mold compound. Small die looks OK.



Small die with wire bonds on two edges

C-SAM image from within the mold compound.

C-SAM images



Top side of the large die

Possible die cracks

Wire bonds
near the die
edge

Back side of the Small die

- C-SAM image of the top of the large die.
- There is damage on the die top which looks like several die cracks passing through its center.
- White areas along the cracks are possible delaminations (separations) between the mold and the die top.

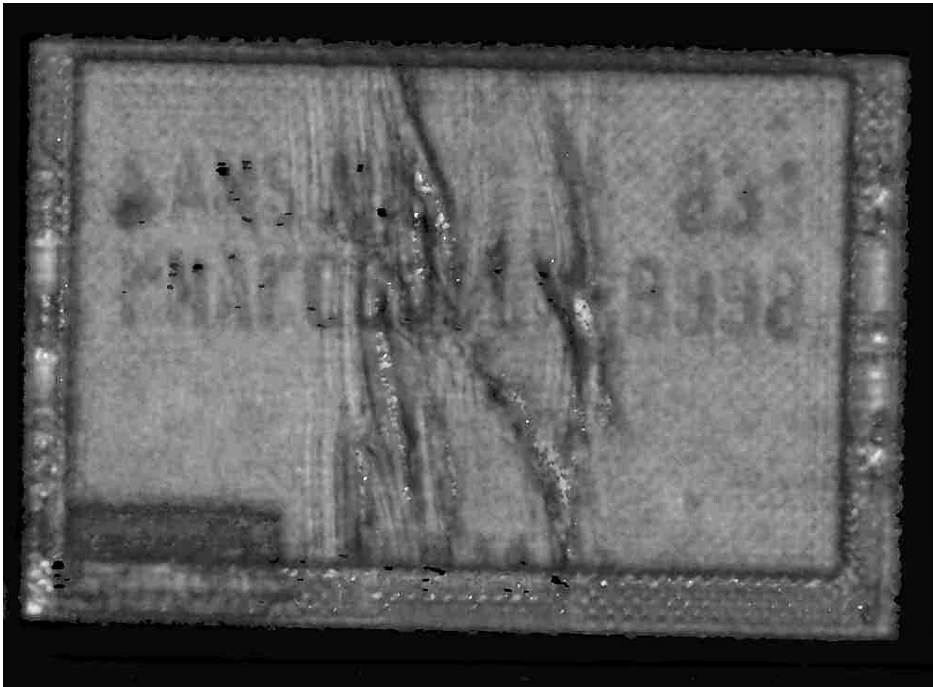


C-SAM image of the back side of the large die (it includes some echo interference from the top layers)

C-SAM images



C-SAM image showing the laminated substrate. No cracks are seen in the substrate.



C-SAM image from the deeper layer showing the laminated substrate under the large die. The image includes shadows of the die cracks.