

# ATTACHMENT 4

TO

SYSTEMS GROUP CHAIRMAN'S FACTUAL  
REPORT

CEN17FA168

Non-destructive Evaluation of the KMH-820 Computer  
U28 Memory Chip

# Non-destructive evaluation of the flash memory package from CEN17FA168



The Small Scale Systems Integration  
and Packaging Center

*A New York State Center of Excellence*



Analytical and Diagnostics  
Laboratory

# Personnel involved

- Package separation: Larry Lehman, In Tae Bae
- Optical Microscopy: Anju Sharma, In Tae Bae
- X-ray microscopy: Anju Sharma
- Acoustic Microscopy: Anju Sharma

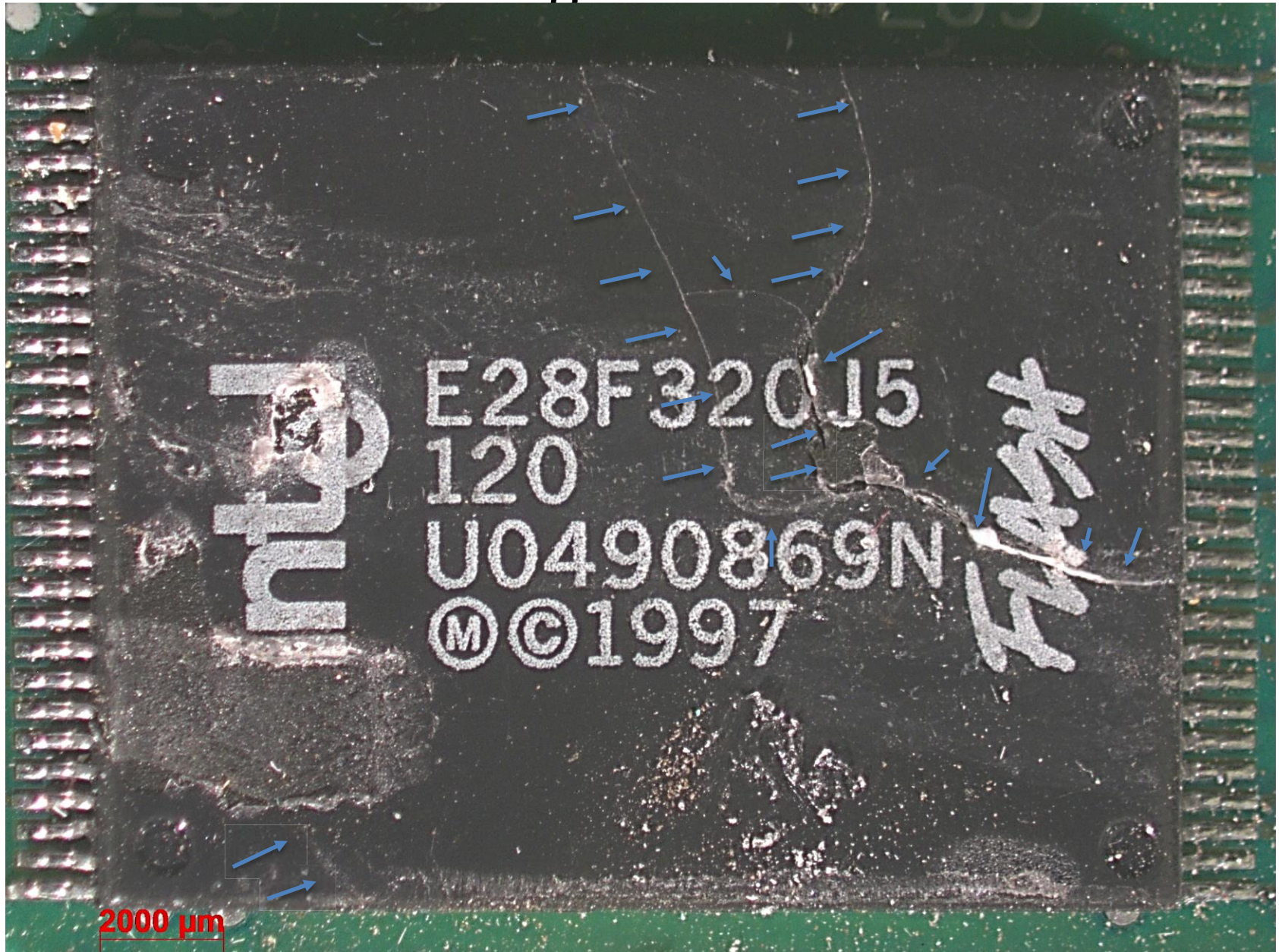
# Summary and Conclusions

- Visual inspection of the U28 flash memory package suggests that there exist severe external cracks on the package mold.
- X-ray inspection revealed that the flash memory package has a wire bonded silicon die. It showed detailed extent of cracks in the package and possibly in the memory die. At least 4 wire bonds to the memory die, are broken along the line of such a crack.
- Acoustic images confirmed that the memory die is severely cracked from the impact damage.
- Since the die is cracked, no digital data can possibly be retrieved from this flash memory package.

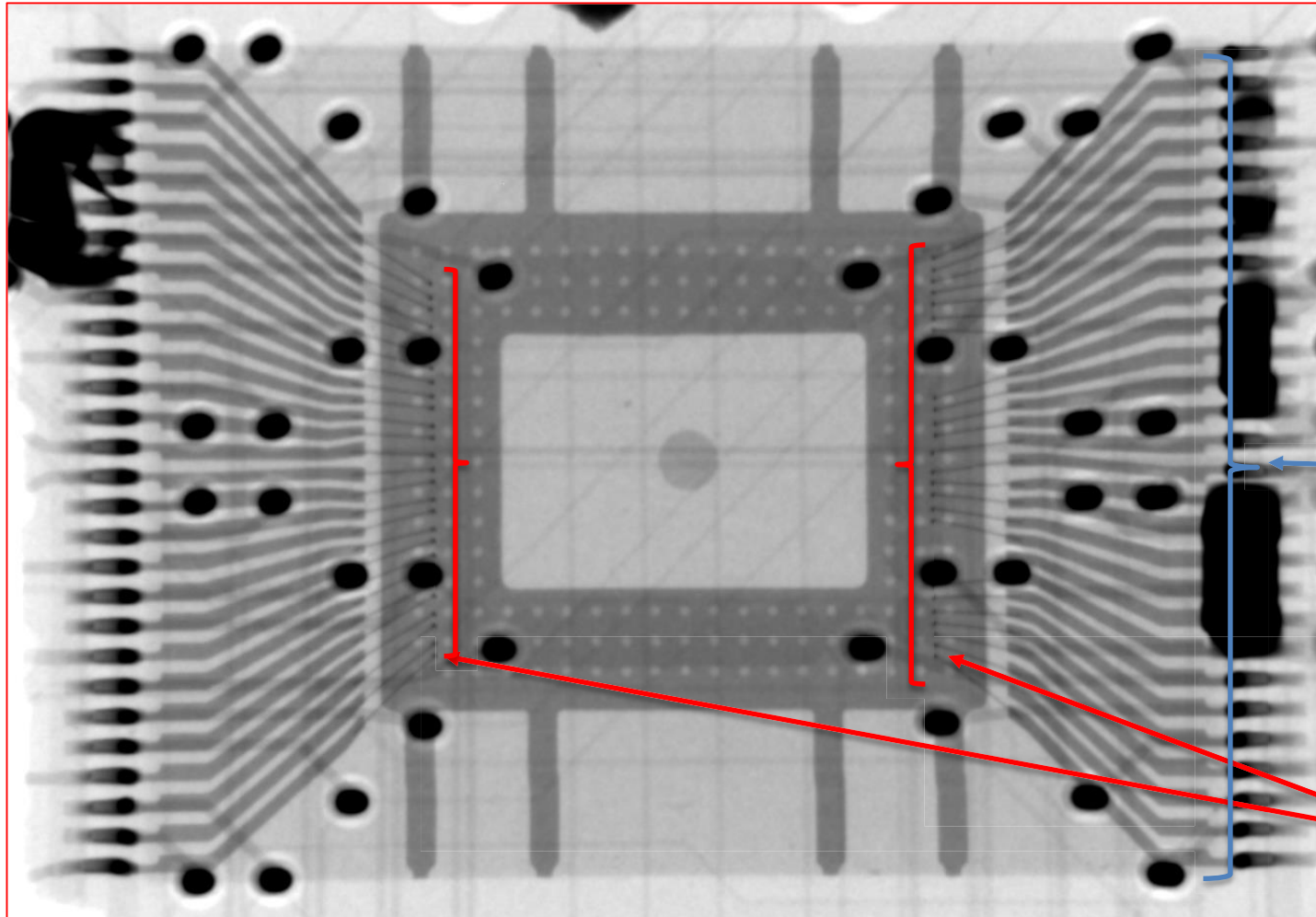
# Experimental Details

- The circuit board containing the flash memory package of interest, U28, was separated from the outer case. This circuit board was severely cracked and bent from impact damage and heat distress.
- Optical images of the U28 flash memory package were taken to investigate the extent of the package surface damage.
- This memory package was then inspected under the Phoenix Nanomex x-ray system. 90kV, 40uA, mode 1 (medium size) x-ray beam and Cu filter were used during the x-ray imaging to eliminate/minimize the possibility of any data corruption from the x-ray exposure.
- X-ray imaging was followed by the Acoustic imaging analysis to examine the package for die cracks.

Optical image of the U28 memory package showing surface cracks



# X-ray image

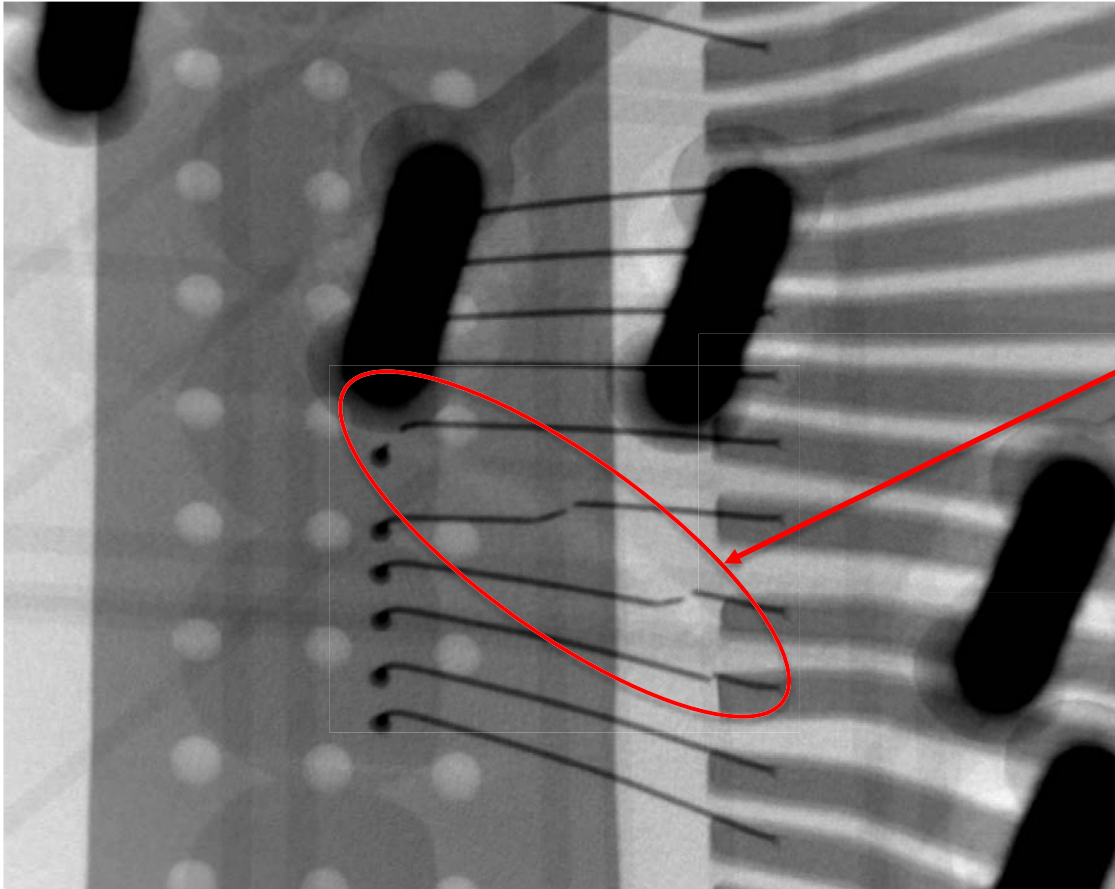


The package contains wire bonded Si die

Lead frame

Wire bonds near the two edges of the die

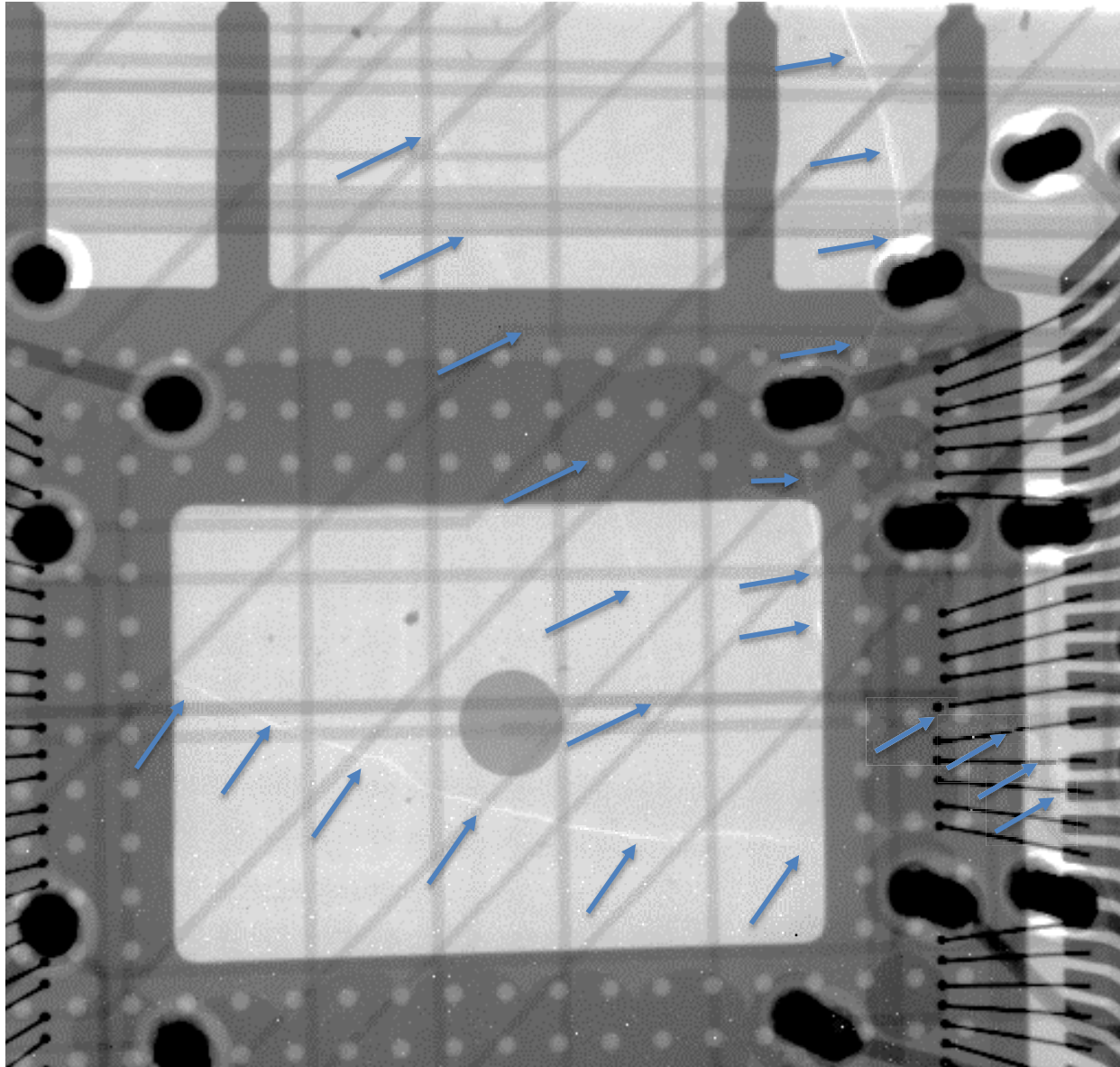
# X-ray image



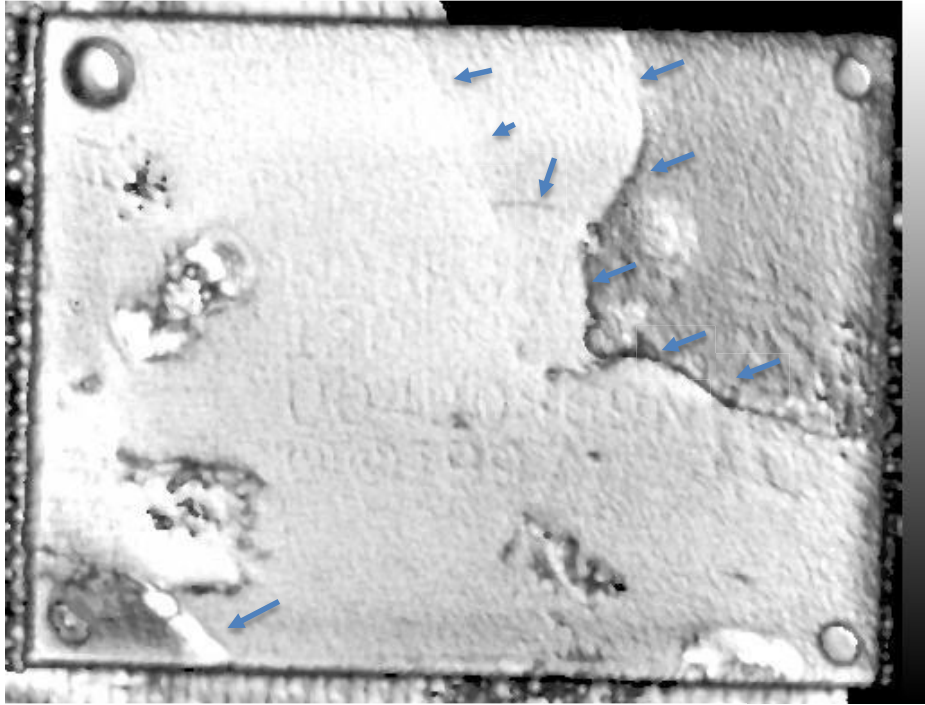
Broken wire bonds along a crack line



# Multiple Cracks in the memory package and possibly the silicon die

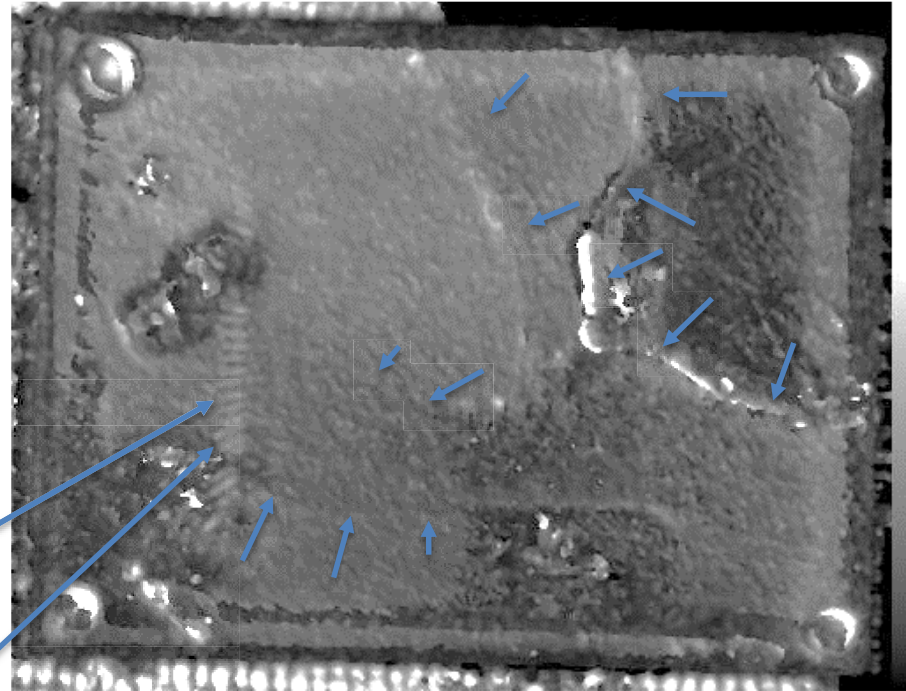


# Acoustic Images



Acoustic image of the memory package top surface showing package surface cracks

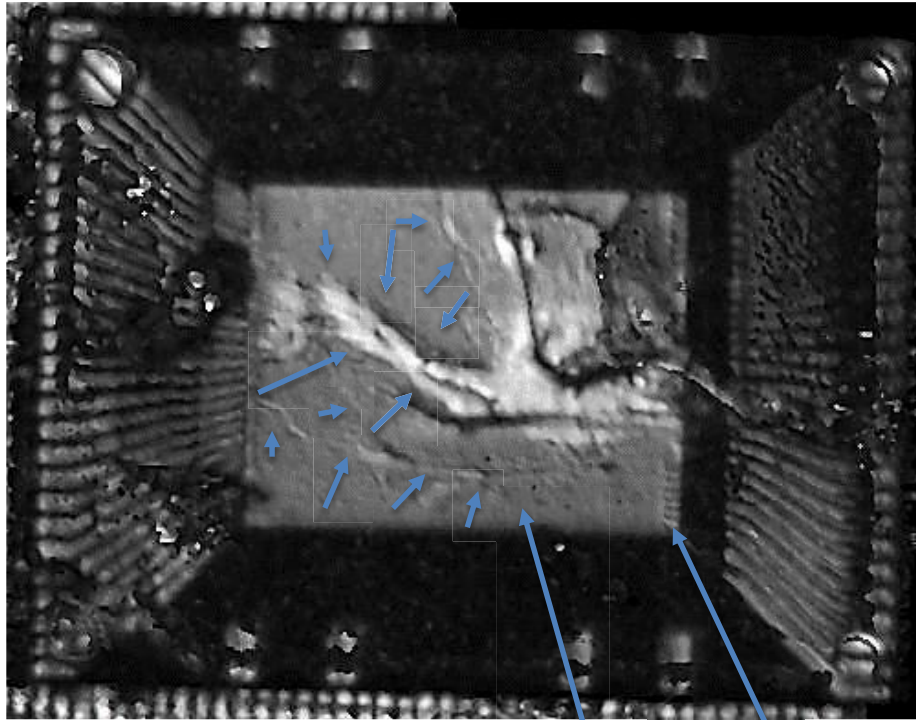
Cracks or shadows of cracks from upper layer



Wire bonds embedded within the mold

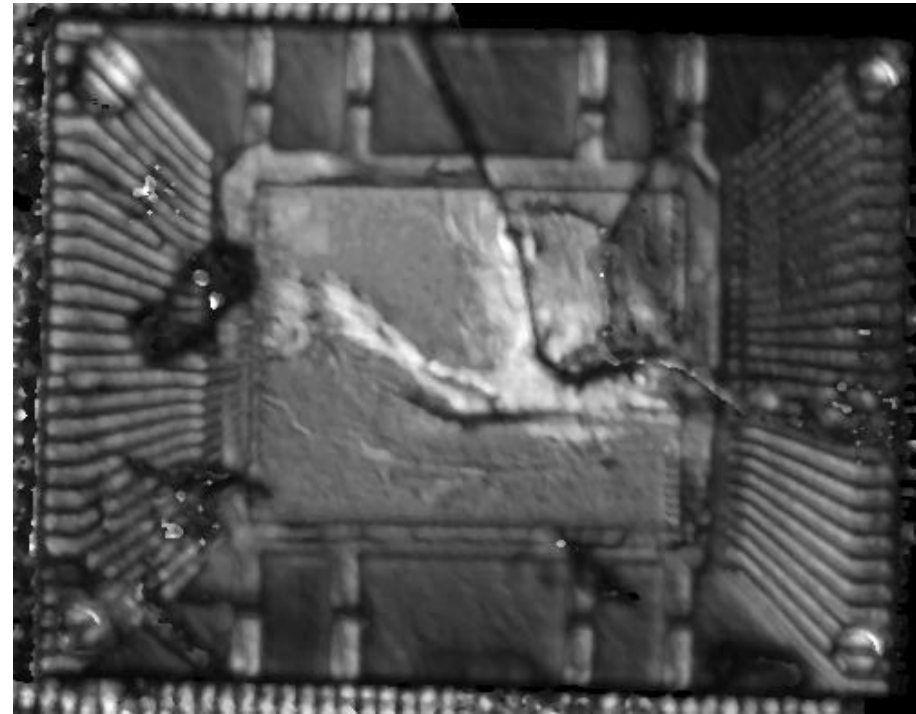
Acoustic image from within the package mold

# Acoustic Images



Die top      Wire bonds

Acoustic image from die surface showing severe cracks in the die



Composite acoustic image showing die, die paddle and lead frame in the package. Multiple cracks can be seen throughout the package.

Acoustic images shows that the memory die suffered severe crack damage from the impact.